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DOCTOR ASSISTANT INFORMATION MANAGEMENT SYSTEM
CASE STUDY: GENERAL HOSPITAL OF NORTH-KIVU

A dissertation submitted to the school of Science and Technology in partial fulfillment of the academic Requirements for the award of Bachelor's degree in Computer science.

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Gisenyi October, 2018

DECLARATION

This is to certify that this project is an original work and was done by me and it has not been submitted elsewhere for the requirement of any degree or diploma or for any other purposes except for publication.

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APPROVAL

This is project entitled Doctor Assistant Information Management System submitted by MWAFRIKA MUFUNGIZI Josue, RN:201520077. And MUTABESHA SARAZA Toussaint, RN:201520504. to the Department of Computer Science, at KIGALI INDEPENDENT UNIVERSITY, is accepted as satisfactory for partial fulfilled of the requirements for the Bachelor degree in Computer Science.

DATE

……..……/……./……

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DEDICATION

We dedicate this research project to our parents, brothers, sisters, relatives and to everyone who contributed to the success of our project morally or scientifically.

ABSTRACT

The importance of a computerized prescription has been recognized by doctors and patients in the last few years. Doctors usually write prescription by hands. This way doctors have been accustomed to write prescription for last few decades. Now technology is being used everywhere and it makes the nature of our life easier and flexible. Therefore, doctor requires a prescription which will be provided by computer for the patient and it will be delivered with a unique identity number. Doctor stores all data belongs to patient in the local database before printing the prescription. As a result, doctor can see previous prescription of a patient if requires by simply typing the identity number or the patient name and can provide another prescription with the same identity number. If requires doctors can easily edit, delete and update the details of a patient. Another important function is also available in the system is that the doctor can see available number of patients, prescription templates, drugs and prescription in the system without making any query in the database. the doctor can also see the history of the patient prescription by choosing the date on which the patient has made a prescription and reply to any query of the patient. To do this patient just need to register in doctor assistant information system with the valid information. Patient can ask for any query related to the prescription. Besides, patient can take appointment after making all the test by directly contacting with the doctor.

In addition, the data collection methodology and software development methodology have been used during the development of this project, in data collection technique we have used the interview because this technique is useful to obtain detailed information about personnel feelings, perceptions and opinions. We have used the observation technique, A key **advantage** of conducting observations is that you can observe what people actually do or say, rather than what they say they do. and finally, we have used the documentation to access inaccessible subjects or difficult subjects.

ACKNOWLEDGEMENT

First and foremost, we thank God Almighty, for giving us the strength, the knowledge to follow and do our work, and the audacity to overcome all difficulties.

I would also like to thank everyone who contributed to the success of our dissertation and who helped us in writing this book.

First of all, my thanks to our supervisor and head of computer science department Mr. NSENGIYUMVA Juvenal of KIGALI INDEPENDENT UNIVERSITY (ULK), who guided us during the process of making our research project and also to the lecturer MARCELLIN NZAYISENGA Habarugira who get used to advise me for the good direction of my research as well as all the staff of the ULK who gave us qualified lecturers for a good training so that we can be able to demonstrate the knowledge acquired in the class to the useful and final year project.

It could not be possible to finish this great work without thanking our parents who guided us a lot in this tuff period of studies we have completed by providing us advices, school fees, food, wearing and so many things. We say thank you a lot.

To all our colleagues and brothers with whom we have been working together in some project such as IRENGE MUFUNGIZI Gloire, MURHULA METRE Lemoisson, PALUKU KAHAMBA Kevin, BUYANGANDU KABEMBA Bernard we say thank you.

LIST OF ABBREVIATIONS AND ACCRONYMS

Cc: Chef Complain

DBMS: Database Management System

DFD: Data Flow Diagram

Oe: On Examination

SDLC: Software Development Life Cycle

SRC: Software Requirement Specification

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CHAPTER 1: GENERAL INTRODUCTION

1.1 BACKGROUND

Nowadays, the technology has become more powerful everywhere in the world and that makes all the tasks to become easier to do by mean of technology. We do not need any more to take longtime dealing with manual things which can lead us to the loss of time and resources by using many papers and energy to do that instead of using computerized system that is the standard way today of working in many enterprises in the world.

Now the time has come to solve those kinds of problems that we used to face in some hospitals of the country due to the lack of the good technology and knowledge of computerization.

That is why, we made this amazing project of doctor assistant to help the doctor to make an easier task related to his or her patient information after doing the examination with the doctor, some different diagnosis, laboratory exams and so on, among those activities we can list some of them such as writing prescription, setting an appointment depending on the availability of the doctor, setting drugs basing on the examination done by the patient and to allow determining how the patient is going to use it , saving all records in the database for the future use when needed in order to see the recorded data available in the database, to add patient's details in the system and delete patient when it is required , to make prescription template for the patient so that the user of the system can fill in prescription easily during the process of making prescription information of the patient. (TUSHAR SAHA, 2017)

Besides, doctor has to write few advices which help the patient to overcome the disease. The Doctor do these tasks by hands. To complete these task one by one doctor needs around ten minutes to write the prescription. ten minutes is not a short time for a patient really. before prescribe doctor has to spend another five to ten minutes to understand the problem of a patient. As a result, important minutes goes vain. besides, there has been added a new problem. The Doctor noticed that majority of the patient forget to bring the previous prescription. if he asks the patient he replies, I came here three months ago how can I preserve the prescription for a long time even its a single page. someone replies I forgot to bring the prescription with me. As a consequence, doctor needs to ask the patient to tell the medicine names which he prescribed last time. sometimes doctor

prescribe without asking anything to the patient because in most cases patient can't say the name of medicines. In this scenario what can be a solution? a doctor assistant information management system can be provided for the doctor. So that he can easily save the information of patient, adding easily patient information for the tests and medicine can make his prescription nice.

Thus, doctor can save his valuable time. Doctor need not remember anything. everything such as tests name and medicines list will be displayed in the screen. doctor just need to add the required tests, appointment and medicines. Once doctor receives the patient details and add tests and medicine he can store the prescription information in the local database. Thus, doctor see previous prescription of a patient if the patient forgets to bring the prescription with them in the next meet or if the patient lost the prescription. (LUCKY MONI 76, 2014)

1.2 PROBLEM STATEMENT

A problem statement is a concise description of an issue to be addressed or a condition to be improved upon. ... The first condition of solving a problem is understanding the problem, which can be done by way of a problem statement. (KUSH, 2018)

During the development of this project we will be focused on how to improve the existing technology comparing to the new one by using some strategies or techniques it means that we will try to provide a complete solution for the manual management of the general hospital of Goma related to the doctor and his patients and many other services.

Today many hospitals still have problems of managing patient's information because of the technique being used when managing patient's information, the main cause of the problem is that many of hospitals still use the manual system which is no longer applied in developing countries, many patients are not satisfied reason why, some of them go to find other hospitals because they are disappointed by the current system and their information are not safe enough. (JAMILE KHOURY,2015)

In the current system we have some problems that prevents the doctor to advance as quick as possible because the system in use is still very low and resources are also poor compared to other technologies found earlier, (RICKIE JOHN,2009).

basing on the current system, some of the main problems are:

- Usage of lot of papers to write prescription by hands.
- Loss of patient's information because the information is not safely kept as the system is paper based one.
- No information recovering with their system.
- Loss of patient's receipts written by hands by the doctor.
- Patients use to forget about the appointment fixed by the doctor.

From the above problems we asked ourselves the following questions:

1) How does the doctor manage patient prescription?

2) What the patient do so that he/she can stay in communication with his doctor?

The above questions will be answered in the next paragraph in the hypothesis to satisfy the person who need to know more about it.

1.2 HYPOTHESIS

A hypothesis is a supposition or proposed explanation made on the basis of limited evidence as a starting point for further investigation, it is an educated prediction that can be tested.

In order to manage the patient prescription, the doctor would need to conduct some research such as to listen to the main patient's complain, to examine the patient in order to detect the disease, to make provisional diagnostics and waiting for the result to proceed with the differential diagnosis to completely know the appropriate drugs to prescribe the patient after that the doctor must perform the laboratory examination to well cure the diseases of the patient, the doctor must ensure himself that the disease is well known and it's under treatment with appropriate drugs to well set the prescription .

That prescription information is related to the patient's diseases such as how the patient will take the medicine and when to take it, he/she need to know also how much per day is going to take the drug must and all the provided information must be clearly shown. The prescription also will show

to the patient the time he/her will need to rest, it shows also the exams that the patient must do and the result of that.

To be in closer communication with the doctor the patient must have a printed paper that contains all information about him given by the doctor and that paper must contain the date of the rendezvous so that he/she can remember when to come to the next appointment with the doctor.

1.4 INTEREST OF THE PROJECT

Let's mention that this project was not chosen randomly**,** we chose it with the interest of improving the way of working in our country especially when dealing with some hospital to let patients communicate with their doctors safely.

1.3.1 Personal Interest

During the development of this project, it will allow us to:

- Apply the knowledge acquired from books and from the class.
- Gain more about computer skills to help develop the world.
- Help to solve different problems found in real life of Information technology.

1.3.2 Public Interest

At the end of this this project, the patients will benefit from it as:

- It will serve them effectively and timely.
- The time lost by making manually computations operations will be reduced

1.3.3 Academic Interest

At the end of this project, this project will help other students who want to make research on what we achieved and what we didn't achieve in other to go further and faster.

1.5 Objectives of the study

In this project we have two main categories:

- General objective and
- Specific objective

1.5.1 General Objective

The main objective of this project is to develop or improve the quality of managing the interaction between patient and doctor effectively and efficiently.

1.5.2 Specific Objective

Are statements that describe:

- Results in terms of knowledge, attitude, skill, aspiration, and behavior
- Participant performance, rather than trainer performance or instructional procedure
- Expected performance change at the job site

The following are the specifics objective of the project:

- Providing a printed prescription to the patient.

-Counting automatically the number of existing patients in the system.

- To create a database of all patients

- Printing and viewing the history when a date is selected.

- Making patient's templates for recording.

- Modifying record when are needed.

1.6. Scope of the study

In order to conduct a scientific research, a researcher must have a precise and clear delimitation study, therefore, in the next paragraph we are going to scope our project in space, in time and in domain.

1.6.1 Scope in time

This project is built in 2018 with the purpose of solving different problems that prevent the doctor to well manage the patient's prescription and information in general since the observation of it.

1.6.2 Scope in domain

Because the general hospital of north-kivu has many different department and services, it is very difficult to manage all the service because it requires to gather all possible information to well

design the system of the whole hospital, our project doctor assistant information management system will be limited on the doctor assistance to serve the doctor effectively, efficiently and timely by focusing on providing the easier way that help the Doctor to manage patient's prescription by mean of computerized system.

1.6.3 Scope in space

The research project was done to the general hospital of north-kivu that is located in the DRC country in the north-kivu province precisely in Goma town in the district of Goma.

1.7. METHODOLOGICAL APPROCH

To complete a such scientific work is not hazardous. It results from the research methodology and the chosen techniques.

1.7.1 Methodology

In research methodology we have two kinds of methodology:

a) Data collection methodology

During the development of this project we use the "Structure Systems Analysis and Design Methodology (SSADM)" which is a system approach to analyze and design of the information

1.7.2 Techniques

In order to collect data, we have used interview, observation and documentation.

- **Techniques of interview**

An interview technic it is a conversion where questions are asked to elicit information.

System. (DAVID ARNOLD, 2018)

this technique is based on the communication between the interviewer and the interviewee to allows us to ask many questions regarding to our study to different doctors responsible for managing patient's record, prescription and to interact with them every time.

- **Technique of documentation**

In order to conduct my research, documentation technique have been used for consulting a wide variety of documents such as different books in the library, website to read some online courses,

- **Techniques of observation**

this technique of research concerns the planned watching, recording and analysis of observed behavior as it occurs in a natural setting in observing, we have been able to understand the functionality of the earlier system.

(Richie, 2018)

b) Software development methodology

In this step, we are going to use a SDLC which is the process used by the software industry to design, develop and test high quality software. The SDLC aims to produce a high-quality software that meets or exceeds customer expectations, reaches completion within times and cost estimates.

(margherit, 2011)

The following figure is a graphical representation of the various stages of a typical SDLC.

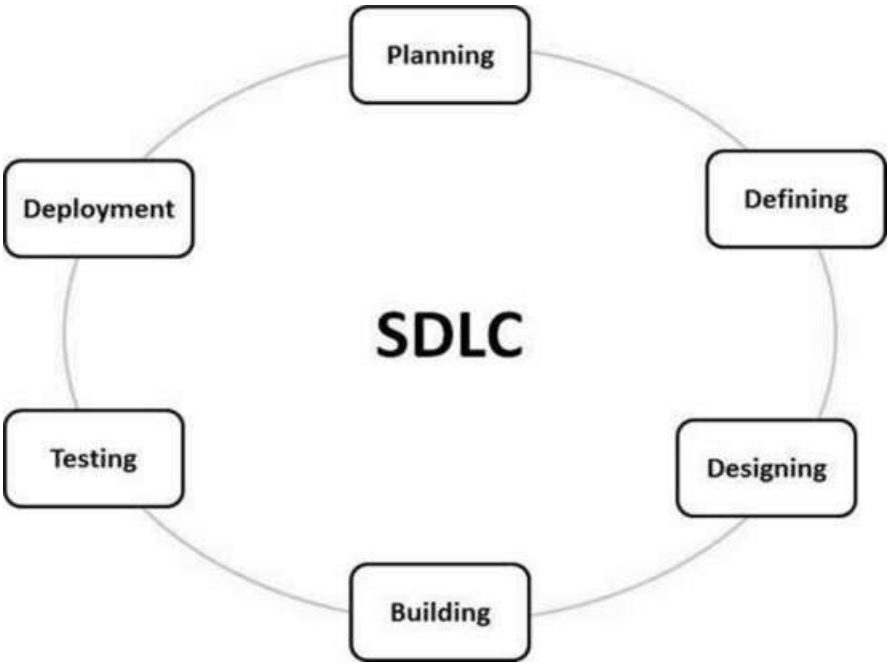


Figure 1. System Development Life Cycle (SDLC)

Source: From Tutorialspoint.com

Stage 1: Planning and Requirement Analysis

Requirement analysis is the most important and fundamental stage in SDLC it's performed by the senior members of the team with inputs from the customer, the sales department, market surveys and domain experts in the industry.

The planning for the quality assurance requirements and identification of the risks associated with the project is also done in the planning stage.

Stage 2: Defining Requirements

Once the requirement analysis is done the next step is to clearly define and document the product requirements and get them approved from the customer or the market analysis. This is done through an SRS (Software Requirement Specification**)** document which consists of all the product requirements to be designed and developed during the project life cycle.

Stage 3: Designing the product Architecture

SRC is the reference for product architects to come out with the best architecture for the product to be developed.

Stage 4: Building or Developing the product

In this stage of SDLC the actual development starts and the product is built. The developers must follow the coding guidelines defined by their organization and programming tools like compilers, interpreters, debuggers, etc. are used to generate the code.

Stage 5: Testing the product

This stage is usually a subset of all the stages as in the modern SDLC models, the testing activities are mostly involved in all the stages of SDLC.

Stage 5: Deployment in the Market and Maintenance

Once the product is tested and ready to be deployed it is released formally in the appropriate market

Choice of the SDLC models

There are various software development life cycle models defined and designed which are followed during the software development process but among them we are going to choose the waterfall model for our project.

3.4.1 Waterfall model

Waterfall approach was the first SDLC model to be used widely in software engineering to ensure success of the project. in this model approach, the whole process of software development is decided into separate phases and the outcome of one phase acts as the input for the next phase sequentially. (Fernando, 2017)

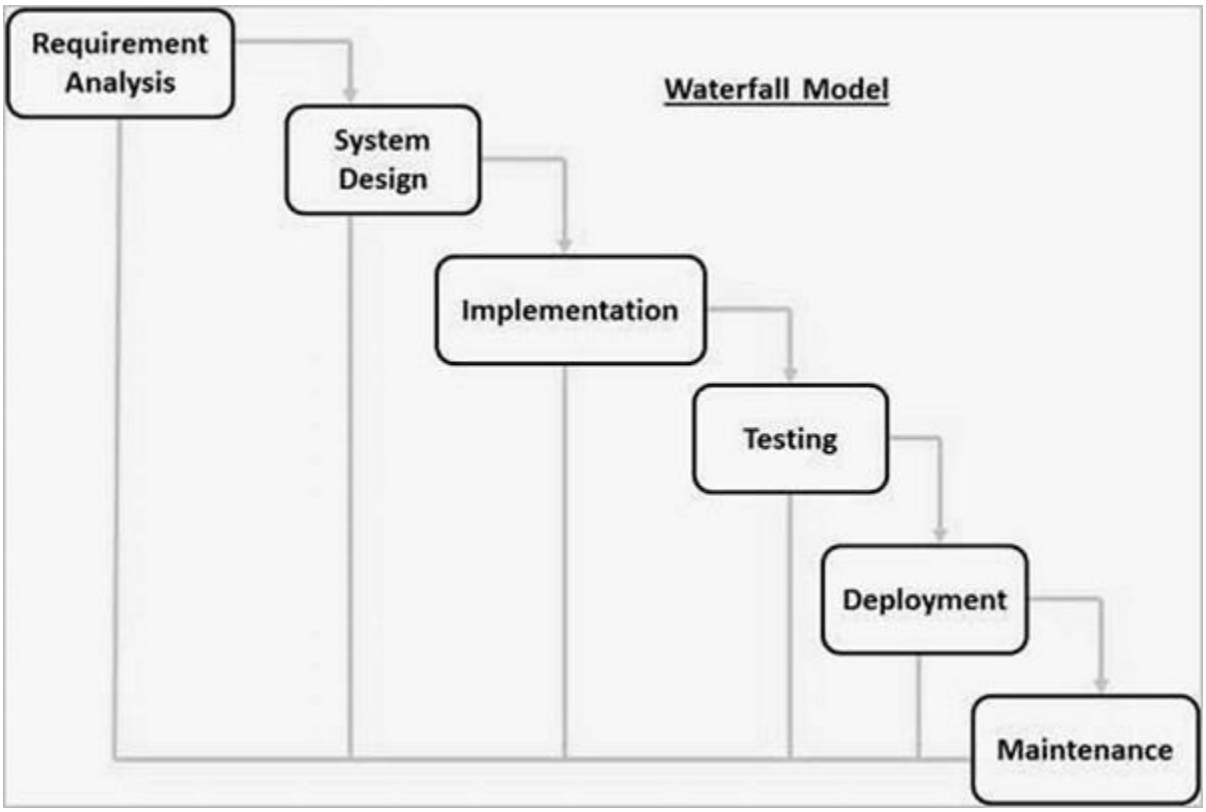


Figure 2. Waterfall model

source: From Tutorialspoint.com

The sequential phases in Waterfall model are:

- **Requirement Gathering and analysis** − All possible requirements of the system to be developed are captured in this phase and documented in a requirement specification document.
- **System Design** − The requirement specifications from first phase are studied in this phase and the system design is prepared. This system design helps in specifying hardware and system requirements and helps in defining the overall system architecture.
- **Implementation** − With inputs from the system design, the system is first developed in small programs called units, which are integrated in the next phase. Each unit is developed and tested for its functionality, which is referred to as Unit Testing.
- **Integration and Testing** − All the units developed in the implementation phase are integrated into a system after testing of each unit. Post integration the entire system is tested for any faults and failures.
- **Deployment of system** − Once the functional and non-functional testing is done; the product is deployed in the customer environment or released into the market.
- **Maintenance** − There are some issues which come up in the client environment. To fix those issues, patches are released. Also, to enhance the product some better versions are released. Maintenance is done to deliver these changes in the customer environment.

Waterfall model advantages

- Simple and easy to understand and use
- Easy to manage due to the rigidity of the model. Each phase has specific deliverables and a review process.
- Phases are processed and completed one at a time.
- Works well for smaller projects where requirements are very well understood.
- Clearly defined stages.
- Well understood milestones.

- Easy to arrange tasks.
- Process and results are well documented.

1.8. Project Gantt chart

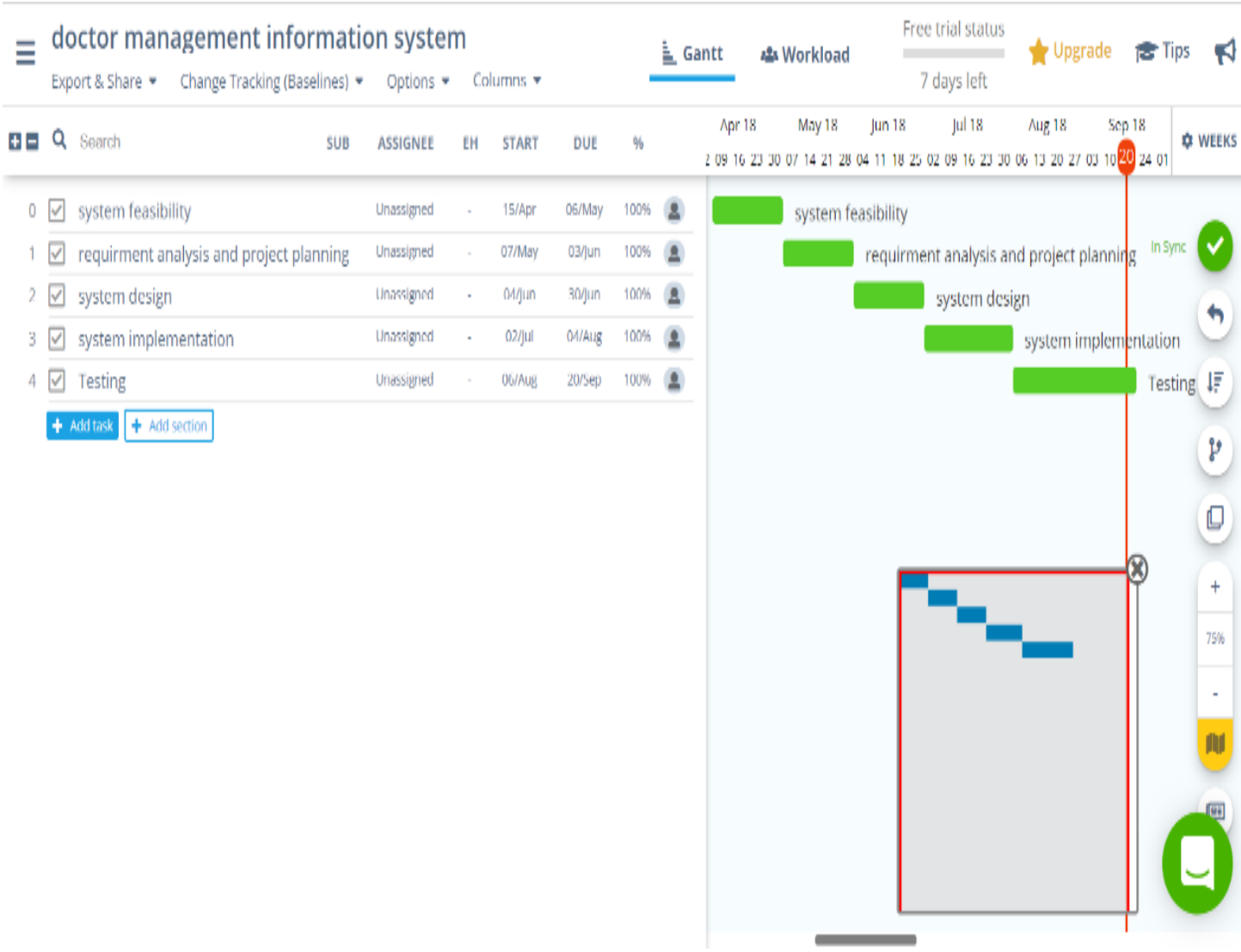


Figure 0. Gantt chart for the project

Source: from online Gantt chart

1.9 Organization of the project

This project contains five chapters:

Chapter 1: The General introduction; This chapter is concerned with problem statement, problem scope and project purpose.

Chapter 2: Literature Review; This chapter deals with the theoretical concepts it means it provides a description, summary and evaluation of each source.

Chapter 3: System analysis and design; In this chapter we analyze the current system, the new one then put in place the methodology to be used, tools and the system requirements.

Chapter 4: System implementation: In this chapter we will proceed by showing exactly how the system will work, in other words, we will:

- show How the information system should be built (i.e. physical system design).
- Ensure that the information system is operational and used.
- Ensure that the information system meets quality standard (i.e. quality assurance).

Chapter 5: Conclusion and recommendations; In this chapter we provide the general conclusion of the project and the recommendation of it.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

The main purpose of this chapter is to provide to the reader a complete understanding, comprehensive and practical set of concepts and explanations used in this project.

This project contains a set of guidelines and most important information to develop this project in easier and tangible manner.

Our study will provide the best way to interact with the desktop application and represents best and important background information on the characteristics, features and benefits of the desktop application in professional and practical life. It provides a well understanding of doctor assistant information system, database and related tools to support the conception and development of this project.

2.2 Definition of key terms

2.2.1 Doctor

A person with a medical degree university qualification whose job is to treat people who are ill or hurt. (A.JOHNSON, 2018)

2.2.2 Doctor Assistant

A doctor assistant can be someone or something that is there to help the doctor to execute something.

A doctor Assistant is an allied health professional that supports the work of physicians and other health professionals, generally in the clinic. (KRUSH HELL, 2018)

2.2.3 Patient

A patient is a person receiving or registered to receive medical treatment or a sick individual especially who is waiting or under the care and treatment of a physician or surgeon or doctors.

(TREASURE, 2016)

2.2.4 Information

Information can be defined as data converted into something valuable and usable for certain user.

2.2.6 Software

A software is a collection of computer programs and related data to provide instructions for telling computer what to do and how to do it.

A software refers to one or more computer programs and data held in the storage of the computer for given objectives.

It is also a set of programs, procedures, algorithms and its documentation. (Margaret Rouse, 2014)

2.2.7. System

A system is a collection of different parts working together for a common purpose or objective.

(MARGARET ROUSE, 2015) for example, an information system that collects and stores data.

Or by considering a computer system that refers to the hardware and software component that run computers.

2.2.8 Database Management System (DBMS)

A database management system (DBMS) is the software allowing a computer to perform database functions such as storing, adding, deleting and modifying data.

The database management system (DBMS) is the software that interacts with end users, applications, and the database itself to capture and analyze data. A general-purpose DBMS allows the definition, creation, querying, update, and administration of databases.

(DAVID , 2018)

Relational database management system (RDBMS) implements the relational model of tables and relationships.

Ex: Microsoft access, MySQL server, oracle, …

2.2.9 Information system

Information system is defined by Robert A. SZYMANSKI (1990, P22) as a set of people, data and procedures that work together to achieve the common goal of information management.

People, data and procedures are the essential components required in the information system.

Information system allows information to be generated, processed and distributed efficiently and timely because of accurate and timely information allows problem solving and better decision making, this enable successful goal attainment to an organization.

2.2.10 Information Technology

Information technology is defined by (MARTIN WAINWRIGHTS E. et al.1993.91) as a board one encompassing all forms of technologies involved in capturing, manipulating, communicating, presenting and using data i.e. data that have been converted into information.

(HENRY C Lucas 2001, p11) stated that information technology refers to all form of technology applied to processing, storing and transmitting information in electronic form.

2.3 Database concepts

2.3.1 Introduction

Keeping records is one of the most important way for maintaining the availability and security of things in modern word of business. when things are not kept very well data are usually in danger because data can be needed at any time. Data are stored in the database for easier access way and for maintaining the availability and security of things.

The manual search can be applied but it is not a reliable way. These data need to be kept in the safety place for faster access.

2.3.2 Definition

A database is a collection of related tables. It can also include other objects, such as queries, forms, and reports. The structure of a database is the relationships between tables (JILIUS H. 2010, P44)

2.3.3 Description

In order to design a database, we need three things

- ✓ Tables
- ✓ Columns

- ✓ Rows

- **Table**

the table is one of the most important things to design a database. It is a collection of related records such as doctors table, patients table, …

records are the collection of values for all the fields belonging to one entity. E.g. a supervisor, patients, doctor, …

- **Rows**

A table contains rows and rows are collections of instances of one thing, such as the information of the patient. E.g. Patient name, surname, ID, address, telephone, sex, …

- **Columns**

Columns are contained in the tables. It contains all the information of single type. Each column in a table is a category of information referred to as a field.

- **Field**

A field is an area having a record reserved for a specific piece of data.

E.g. Patient ID, patient name and patient table.

2.3.4 Database normalization

Normalization is the process of organizing and designing a data model to well store data in a database.

- **Benefits of database normalization**

The principal benefits are:

- ✓ Improve data integrity
- ✓ Improve faster search performance
- ✓ Avoid redundant data stored
- ✓ Decrease storage requirement
- ✓ Avoid the insert or the update anomalies

- **Forms of database normalization**

We have three normal forms in database:

- First normal form (1NF)
- Second normal form (2NF)
- Third normal form (3NF)

- **First Normal Form (1NF)**

The first normal form (1FN) sets the very basic rules for an organized database:

- Eliminate the duplication of the columns from the same table.
- Create separate table for each group of related data and identify each row with a unique column or set of columns or primary key.

- **Second Normal Form (2NF)**

Second normal form(2NF) consists of removing redundant data, it meets all the requirements of the first normal form.

It also removes subsets of data that apply to multiple rows of a table and move them to a separate table then it creates relationships between these new tables and the previous through the use of tables.

- **Third Normal Form (3NF)**

This normal form goes one large one step further: It meets all requirements of the second normal form.

CHAPTER 3: SYSTEM ANALYSIS AND DESIGN

The system analysis and design are concerns with the examination of a problem and the creation of its solution. Systems analysis is effective when all sides of the problem are reviewed. Systems design is most effective when more than one solution can be proposed.

ANALYSIS OF EXISTING SYSTEM

3.1.1: Introduction

The main objective of this chapter is to analyze and describe deeply how the actual manual system of General hospital of north-kivu works. This chapter present also the problems caused by such manual works and finally propose the clear solution to the identified problems.

Before making any comment or critical analyze to the existing system it's worthy to understand first how the existing system works in order retrieve some errors in it to be corrected and to make some improvement.

3.2 DESCRIPTION OF THE CURRENT SYSTEM

3.2.1 Introduction

In this phase, we describe and list all the problem that we face in the current system that must be solved in the new one and we propose a solution for that as well as the analysis of the proposed system.

In the current system, the patient's registration was done manually because the system is not computer oriented. The existing system takes a long time to provide prescription for the patients and it doesn't save the time, all the patients who need an appointment from the doctor they have to fill the form and there is no quick follow-up given to them and their data are not stored in the database for future use. These are factors that cause the delay of services to the hospital because patients spend more time waiting for the prescription and sometimes patients impatiently go back home or they look for another hospital that will satisfy them for their needs.

Actually, the world has advanced in technology and people don't need anymore to deal with manual tasks that will take them long time to be served depending on their need in any kind of management, the first thing that we have to consider is the time management. For that, we designed a "patient prescription information management system" that will help timely and efficiently to manage patient's prescription for saving time and storing patients record in the database.

3.2.2 CURRENT SYSTEM PROBLEM

The following problems are the problems identified in the current system after analyzing it:

- The existing system uses a lot of papers for the patient's prescription.
- There is no database for storing patient's information.
- Patients spend more time waiting for the prescription.
- The existing system it's time consuming and costly to produce prescription.
- Sometimes the doctor doesn't remember the number of available appointments he set to patients.
- Lack of confidentiality.
- Lack of efficiency, the patients can modify the written prescription for personnel purpose.
- We don't know the available number of patients in the system
- We don't know the available number of prescriptions in the system.

3.3. PROPOSED SYSTEM

To solve all those problems we list above, we proposed a new computerized system which is called **"**patient prescription information management system**"**. In the following, we are going to describe the new system and to show how important it will be comparing to the current one.

3.3.1 Analysis of new proposed system

The proposed system is computerized as the technology is getting advanced very fast, everything needs to be updated by mean of technology, we need to update the manner of working to satisfy the need of patients so that they can trust us. Now we are going to design a system called **"**patient

prescription information management system**"** that will solve the previous system that patients used to face when dealing with the doctor related to the patient's prescription to the hospital. This system will be very helpful for storing patient's information for future use in the database. This system has several enhanced features that are not in the current system.

This new proposed system has the following capacities:

- Prescription writing for the patient
- Prescription printing for the patient
- Patient Management with the necessary information for about him or her.
- Drug Management with the necessary information for the drug dosage
- Provide prescription templates for the patient.
- Total drug uses by template and prescription
- Providing the history of patient information related to the registration date.

3.3.2 ADVANTAGE OF A NEW PROPOSED SYSTEM

- With this proposed system, there will not be again useless consumption of papers.
- This system will help to store patient's information efficiently in the database.
- This system will avoid data redundancy and data inconsistency
- This system will handle the problem of the loss of data
- This system will ensure the security to not allow information to be modified.
- The problem of paper being torn, burst from fire, destroyed by the rain, water or being lost or stolen will be also solved and for that all the information will be safe or secured.
- This system will provide the patient's information history related to the date of registration.

3.5 SYSTEM REQUIREMENTS

System requirements are the configuration that a system must have in order for a hardware or software application to run smoothly and efficiently. Failure to meet these requirements can result in installation problems or performance problems. (Julius guzer, 2015)

The system requirement has two parts, functional requirement and non-functional requirements, in functional requirement we describe what the system is supposed to do and a non-functional requirement define how the system is supposed to be.

3.5.1. Functional requirements

A functional requirement describes what the system should do, it defines functions of the system and its components. The following are the functional requirements of the future system:

Table 1. Functional requirement table.

DOCTOR	RECEPTIONIST	PATIENT
Check appointments	Directs patients	Request prescription
View available patients in the system	Check-the appointment	Register
View available template in the system	View-available patients in the system	
Update-patient information	View available template in the system	
	Update-patient information	

A function can be defined as a set of inputs, behavior and output of the system, to find the way the patient registration will get access to the system and given a prescription that contains all information about him and the appointment with the doctor, the receptionist will be able to schedule the doctor ,patient, check the appointment view available patients in the system, view

available templates and update patient information, the Doctor should be able to check appointments, to check available patients, check available templates in the system and to update patient information. The administrator should record doctor availability, add patients, update patients, add receptionist, view prescription report, add patient prescription delete patient information.

3.5.2 Non-functional requirements

In this non-functional requirement, we define the system the system property and constraint. And they are classified into three groups: external requirements, product requirement and the organizational requirement.

- The system can run on any operating system
- The system will operate 24h/24 through the internet connection
- The software can run on any web browser installed on the computer

The system must be always available and accessed from anywhere and it has the higher reliability where in case of failures the downtime will be minimal.

3.6. SYSTEM DESIGN

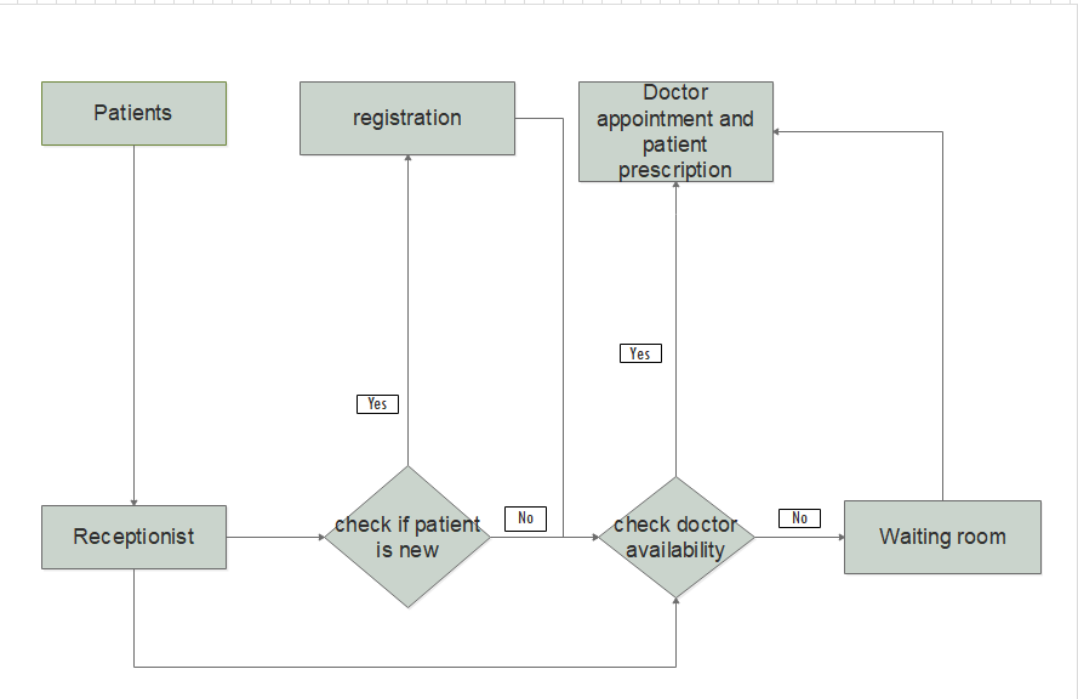


Figure 3. Function Diagram

Source: From Edraw Max

First of all, the patient need to pass to the reception office so that he can get directed by the receptionist of the hospital, once he get in, the receptionist first checks the patient's status if he is new or he is already registered in the system then if he finds that the patients is new he will directs him up to the registration office after being registered, he will come back to check the doctor availability, if the doctor is available then the patient get in to meet with the doctor for the appointment and prescription after being tested, else if the doctor is not available at that time, the patient needs to wait for a while in a waiting room to wait the doctor finish what he's doing.

Now in case the patient is not new, he can pass directly to check the doctor's availability in order to talk to him, if he's available then the patient can get directly to meets with him else he has to wait for the doctor's availability in the waiting room so that he can make an appointment with the doctor.

3.6.1 Process design

A data flow diagram (DFD) is a graphical representation of the "flow" of data through an information system, modelling its process aspects. A DFD is often used as a preliminary step to create an overview of the system without going into great detail, which can later be elaborated. (ECKERT J. 2003).

It is a significant modeling technique for analyzing and constructing information processes

(TOM DEMARCO, 2011)

3.6.2 DFD Symbols

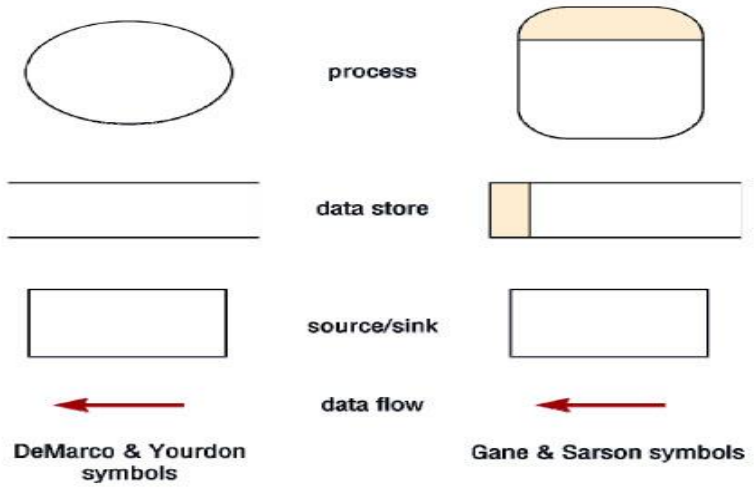


Figure 4. Data Flow Diagram Symbols

Source: From Edraw Max

The DFD has the following four components:

- **External entity:** an outside system that sends or receives data, communicating with the system being diagrammed. They are the sources and destinations of information entering or leaving the system. They are also known as terminators, sources and sinks or actors. They are typically drawn on the edges of the diagram.
- **Process:** any process that changes the data, producing an output. It might perform computations, or sort data based on logic, or direct the data flow based on business rules. A short label is used to describe the process, such as "Submit payment."
- **Data store:** files or repositories that hold information for later use, such as a database table or a membership form. Each data store receives a simple label, such as "Orders."
- **Data flow:** the route that data takes between the external entities, processes and data stores. It portrays the interface between the other components and is shown with arrows, typically labeled with a short data name, like "Billing details."

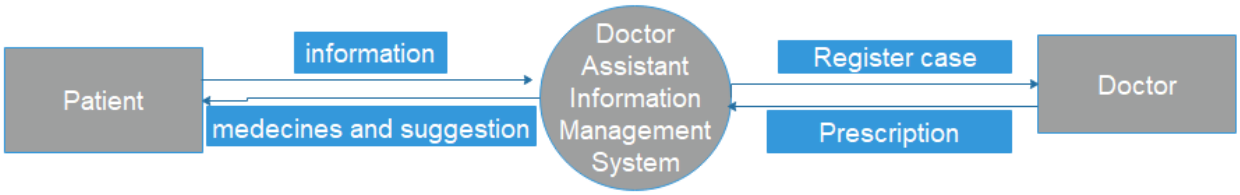


Figure 5. Context level DFD for the system

Source: From Edraw Max

In this system above, the patient information will be first inserted in the Doctor Information Management System then after the patient is registered in the system, the doctor now will get the patient information and write back the patient prescription, the prescription will be registered in the system and the Doctor will provide some medicines and suggestion to the patients and finally print the prescription for the patient.

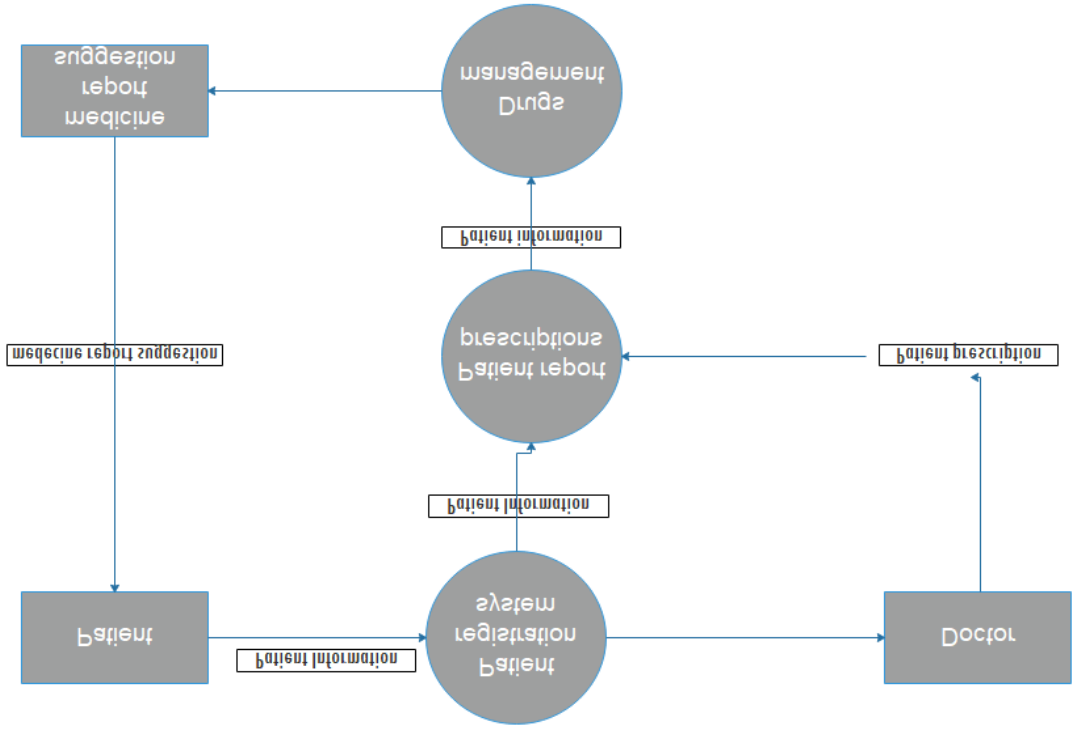


Figure 6. DFD Level 0 (Context Diagram)

Source: From Edraw Max

In the above figure, a patient is registered in the system then the doctor can get the patient information to provide prescription and the patient's registration information should be displayed in the patient report prescriptions after that, the drug will be given to the patient depending on the patient report prescriptions then the Doctor will suggest the medicine to the patient.

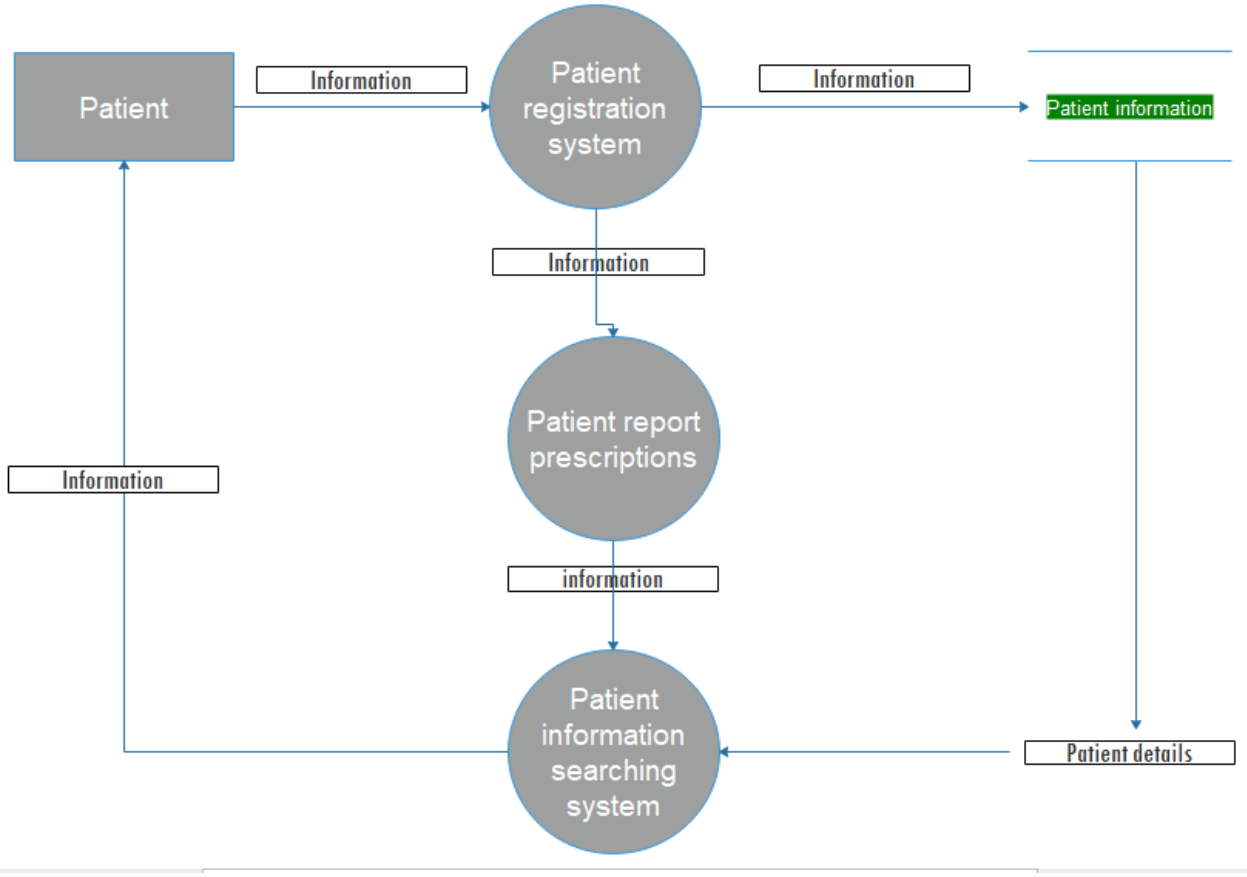


Figure 7. DFD Level 1 for patient prescription information management system

Source: From Edraw Max

In this system, the patient registration information is stored in the database and the patient details can be fetched from the database or through the patient registration information the patient report prescription can be printed and the prescription id can be used to fetch information from the system and then give it to the patient for the next appointment with the doctor.

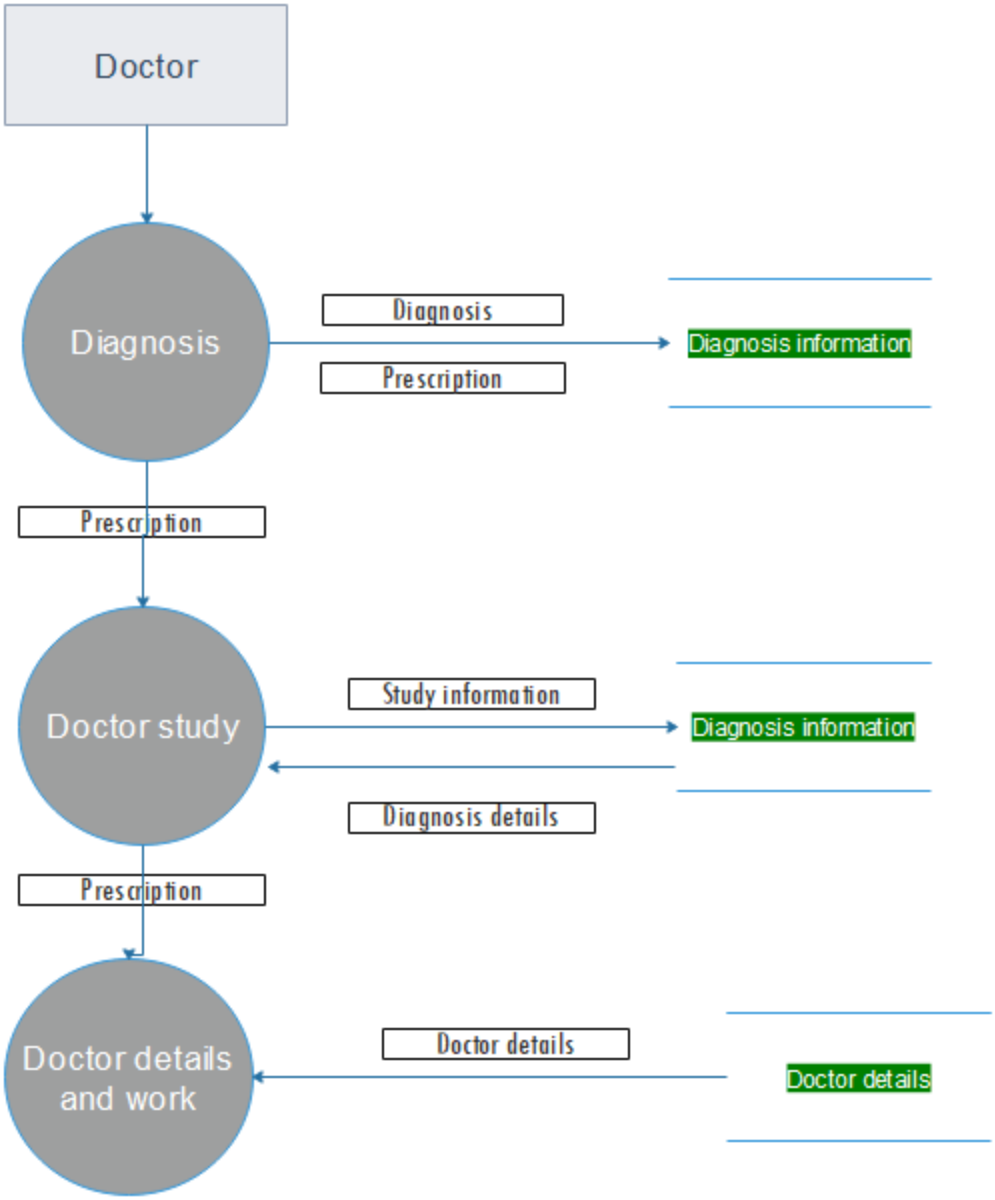


Figure 8. DFD Level 2 for patient prescription information management system

Source: From Edraw Max

This system above illustrates how the doctor will manage the diagnosis, first of all the doctor make the diagnosis basing on the main patient's complain after that, the diagnosis will be stored in the system then the doctor will find the way to make prescription, having a prescription, the doctor now will study the diagnostics information and he provides the diagnosis details after analyzing in

the system, finally the doctor details will be also provided and the task to be done, then doctor details is stored in the system.

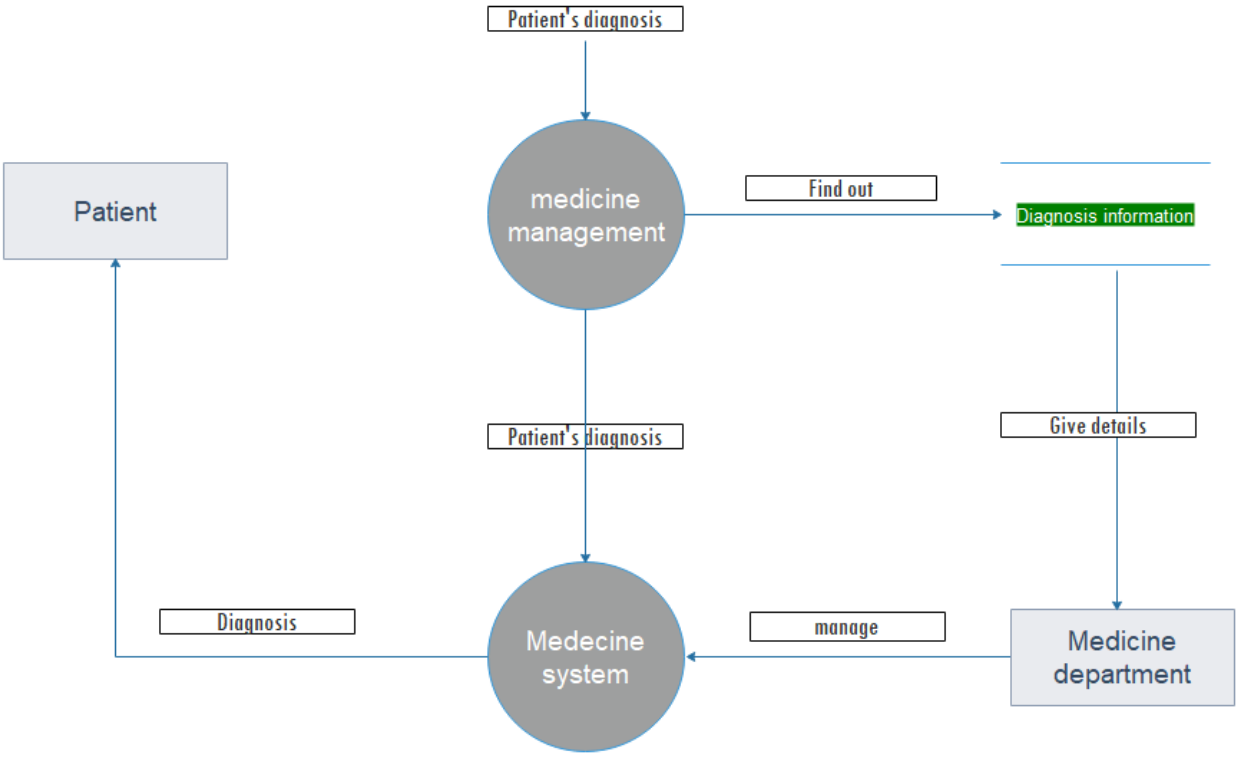


Figure 9. DFD Level 3 for patient prescription information management system

Source: from Edraw Max

After the Doctor has made a diagnosis to the patient, now he can check in the medicine list to find out the corresponding medicine corresponding to the patient's disease then in stored diagnosis the doctor can provide a detailed information to the medicine department to decide to on the drug and in the medicine, system is where all possible drugs are found. Finally, the medicine will be given to the patients in prescription file.

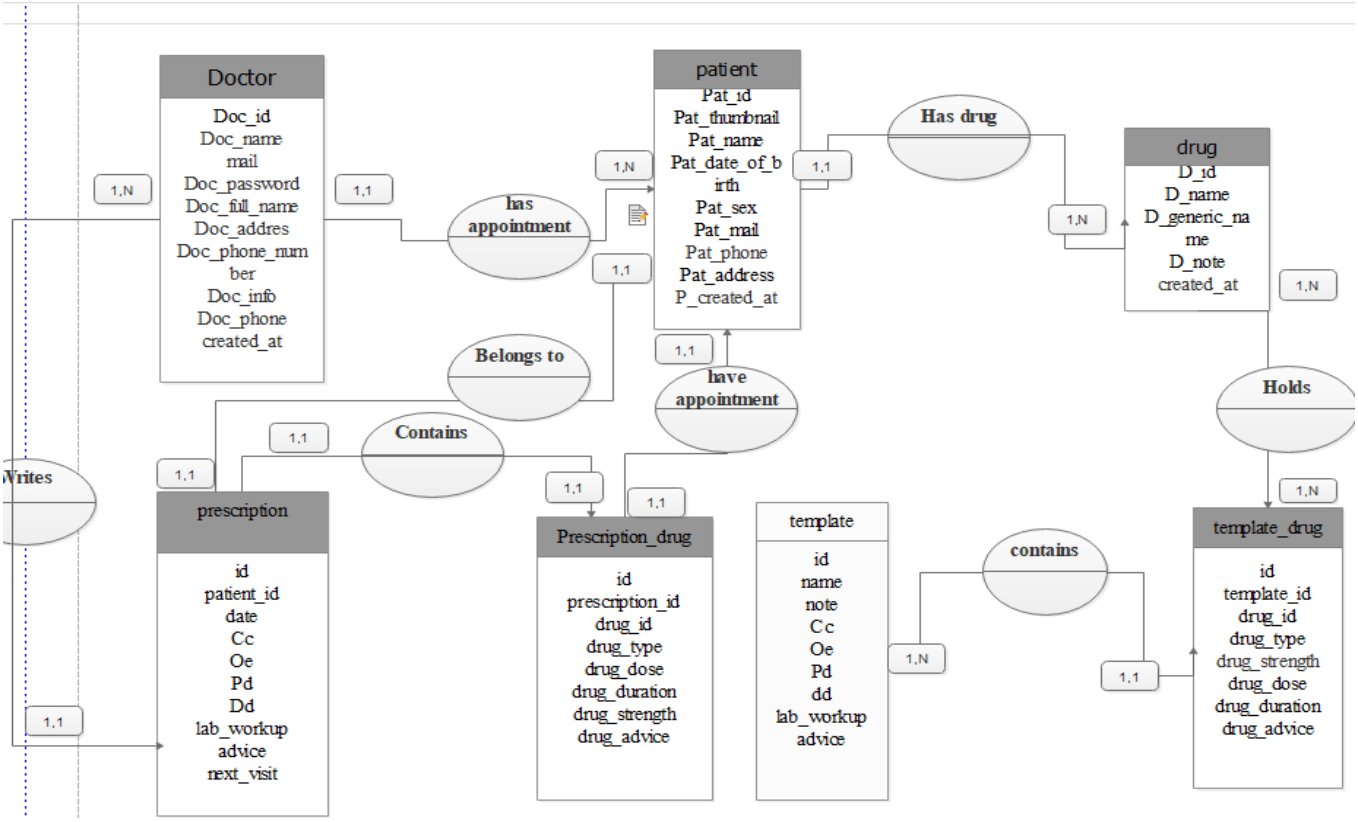


Figure 10. ENTITY RELATIONSHIP DIAGRAM

Source: From Edraw Max

In this ERD above, we have seven entities doctor entity, patient entity, template entity, prescription_drug entity and template _drug entity, all entities are related through a relationship, one doctor can have at least an appointment with one patient or one doctor can have an appointment with many patients. Many patients can belong to one doctor and one patient can belong to one doctor.

One patient can have one prescription, many prescriptions can belong to one patient.

One prescription drug belongs to one prescription or one prescription drug belongs to many prescriptions.

One template drug can have one template or more than one template, many templates can belong to one template.

Template drug can have one or more drugs and many drugs can belong to one template drug.

NO	Entity	Attribute	Data type	Size	Constraints
1	Doctor	Id_doc	Integer	10	Primarykey autoincrement
		User_id	Integer	10	Not null
		Doc_name	text	50	Not null
		Doc_Mail	Text	50	Not null
		Doc_Password	Text	20	Not null
		Doc_full_name	Text	70	
		Doc_Address	Text	150	
		Doc_phone_number	Text	15	
		Doc_Info	Text	150	
		phone_doc	integer	15	Not null
		address_doc	integer	150	Not null
		created_at	Text	10	
2	Patient	Id_patient	integer	10	Primarykey autoincrement
		Thumbnail_patient	Text	15	
		Name_patient	Text	30	Not null
		Date_of_birth_patient	Text	10	Not null
		Patient_Sex	Text	5	
		Patient_Email	Text	20	
		Patient_Phone	Text	15	
		Patient_Address	Text	150	
		Patient_date	Text	10	
3	Drug	Drug_Id	integer	10	Primarykey autoincrement
		Drug_Name	Text	50	Not null unique
		Drug_Generic_name	Text	20	Not null
		Drug_Note	Text	100	
		Drug_date	Text	20	

4	Prescription_drug	Id_prescr_drug	Integer	10	Primary key autoincrement
		Prescription_id	Integer	10	Not null
		Drug_id	Integer	10	
		Drug_type	Text	20	
		Drug_dose	Text	10	
		Drug_duration	Text	10	
		Drug_strength	Text	10	
		Drug_advice	Text	10	
5	Template_drug	Id_drug_templ	Integer	10	Primarykey autoincrement
		Template_id	Integer	10	Not null
		Drug_id	Integer	10	Not null
		T_Drug_type	Text	20	
		T_Drug_strength	Text	10	
		T_Drug_dose	Text	10	
		T_Drug_duration	Text	10	
		T_Drug_advice	Text	150	
6		Prescr_Id	Integer	10	Primarykey autoincrement
		Patient_id	Integer	10	Not null
		Date	Text	10	
		Cc	Text	150	

	prescription	Oe	Text	150	
		Pd	Text	150	
		Dd	Text	150	
		Lab_workup	Text	150	
		Advice	Text	150	
		Next_visit	Text	100	
7	Template	Temp_Id	Integer	10	Primarykeyautoincrement
		Templ_Name	Text	20	
		Templ_Note	Text	50	
		Temp_Cc	Text	150	
		Temp_Oe	Text	150	
		Temp_Pd	Text	150	
		Temp_Dd	Text	150	
		Temp_Lab_workup	Text	150	
		Temp_Advices	Text	150	

Table 2. 12 DATA DICTIONARY

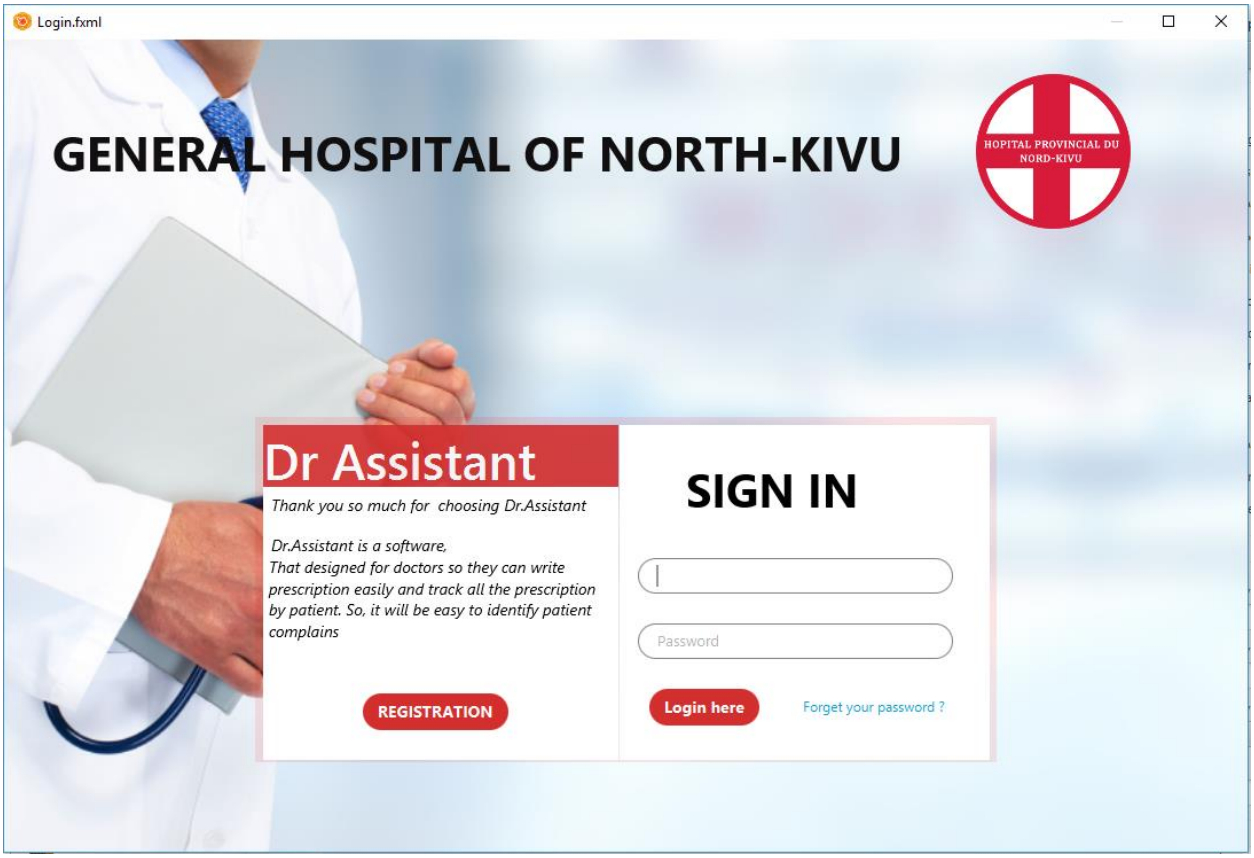
CHAPTER 4. SYSTEM IMPLEMENTATION

Introduction

Systems implementation is the process of: defining how the information system should be built (i.e., physical system design), ensuring that the information system is operational and used, ensuring that the information system meets quality standard (i.e., quality assurance).

Figure 12. Login interface of the information system

Source: From Microsoft Paint



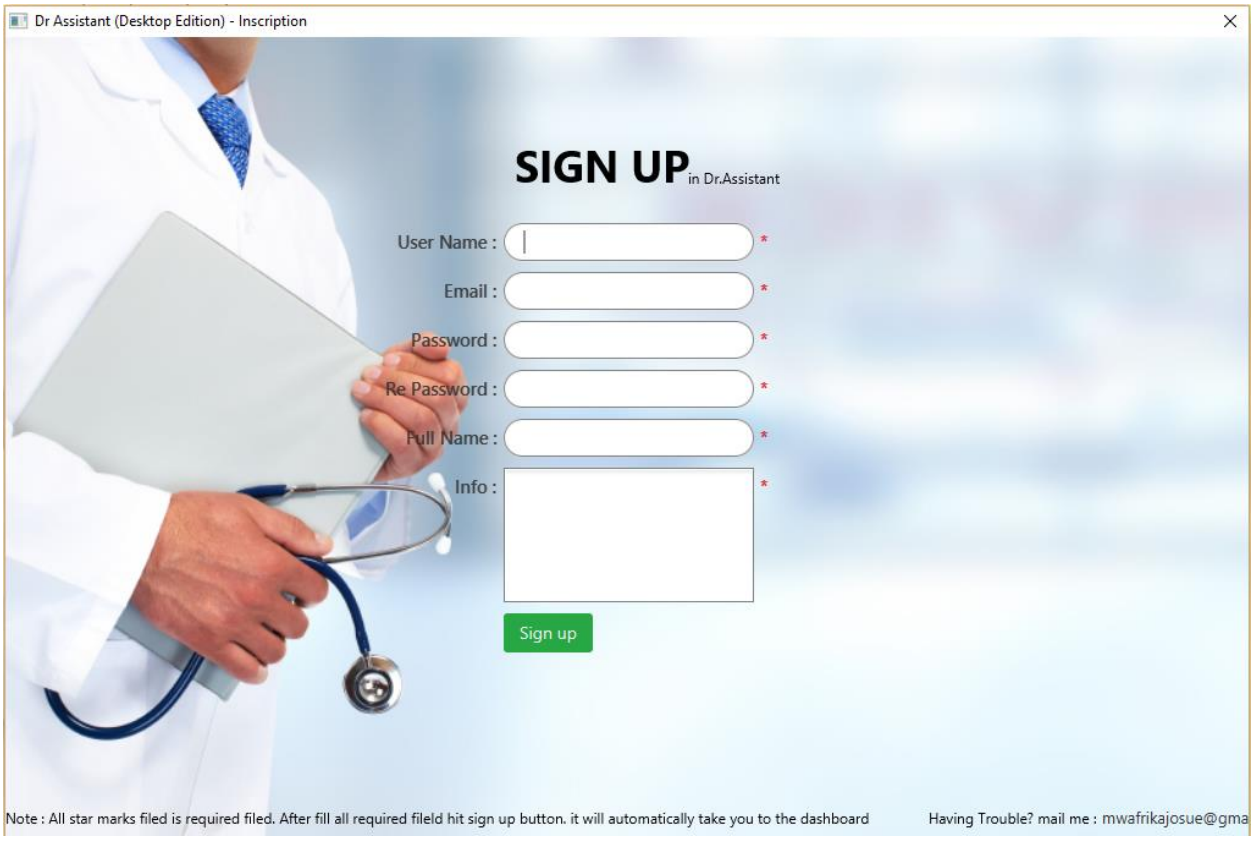
This interface it is the first interface to appear once the system is lunched and it provide the login interface where a user or a doctor registered in the system can login in and manage the patient's prescription. This interface provides also the way to register to the system by pressing the

registration button and then fill in all the required fields or conditions for the registration. Once you register to the system directly it directs you to the dashboard to enjoy the system functionalities.

This system also provides the way of recovering your password in case you forgot it.

Figure 13. Sign up interface

Source: From Microsoft Paint



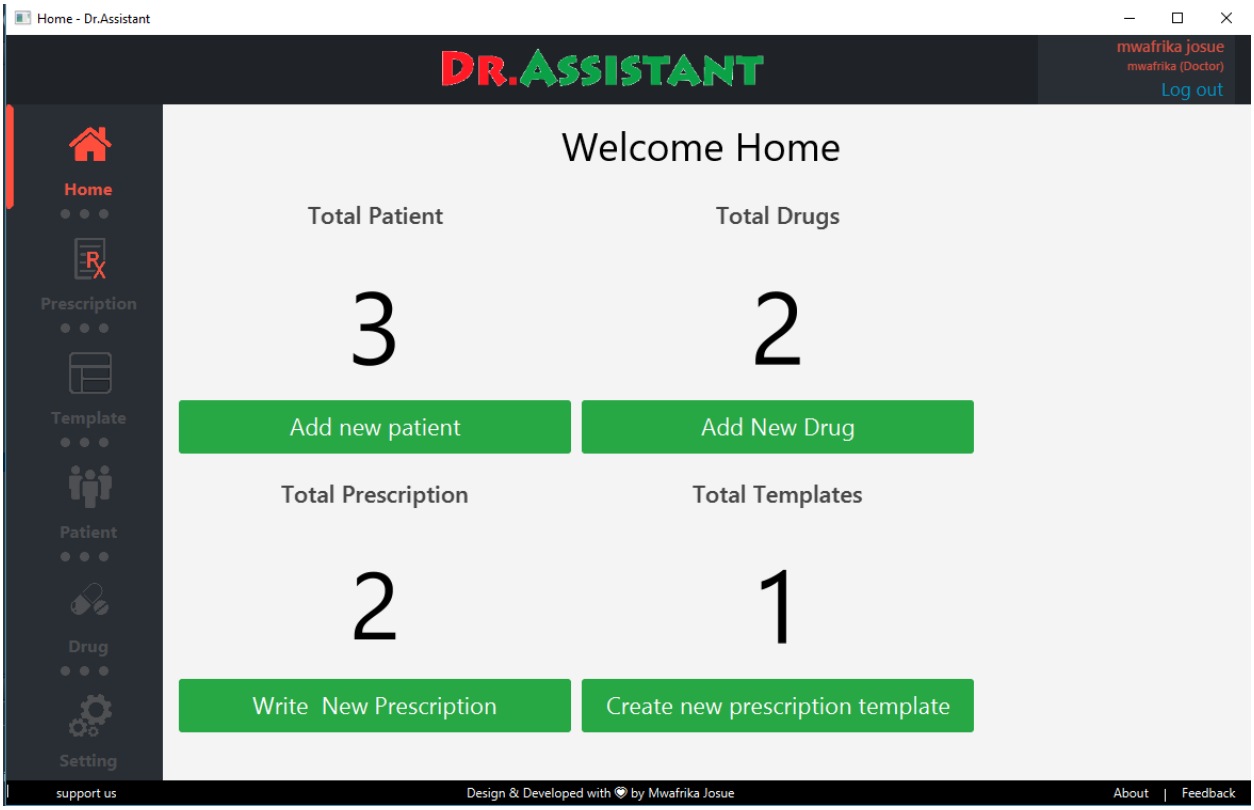
The sign-up interface is the interface that is mainly used for the user or doctor registration in other to access to the system. During the process of registration, the user of the system must fill in all the information in the all field and the required standard form of the mail address, if the user forgets only one field then the system will prompt him or her to complete the empty fields of the system.

In case the user ignores the real and standard form of the mail address, the system will tell him/her that the inserted mail address is not valid.

After finishing to insert information and correct email address, now, the user can press the signup button to be registered successfully in the system.

Figure 14. Home interface

Source: From Microsoft Paint



Once a user is registered successfully in the system, now he can login and access to the main interface which is the home activity. In the home interface we display:

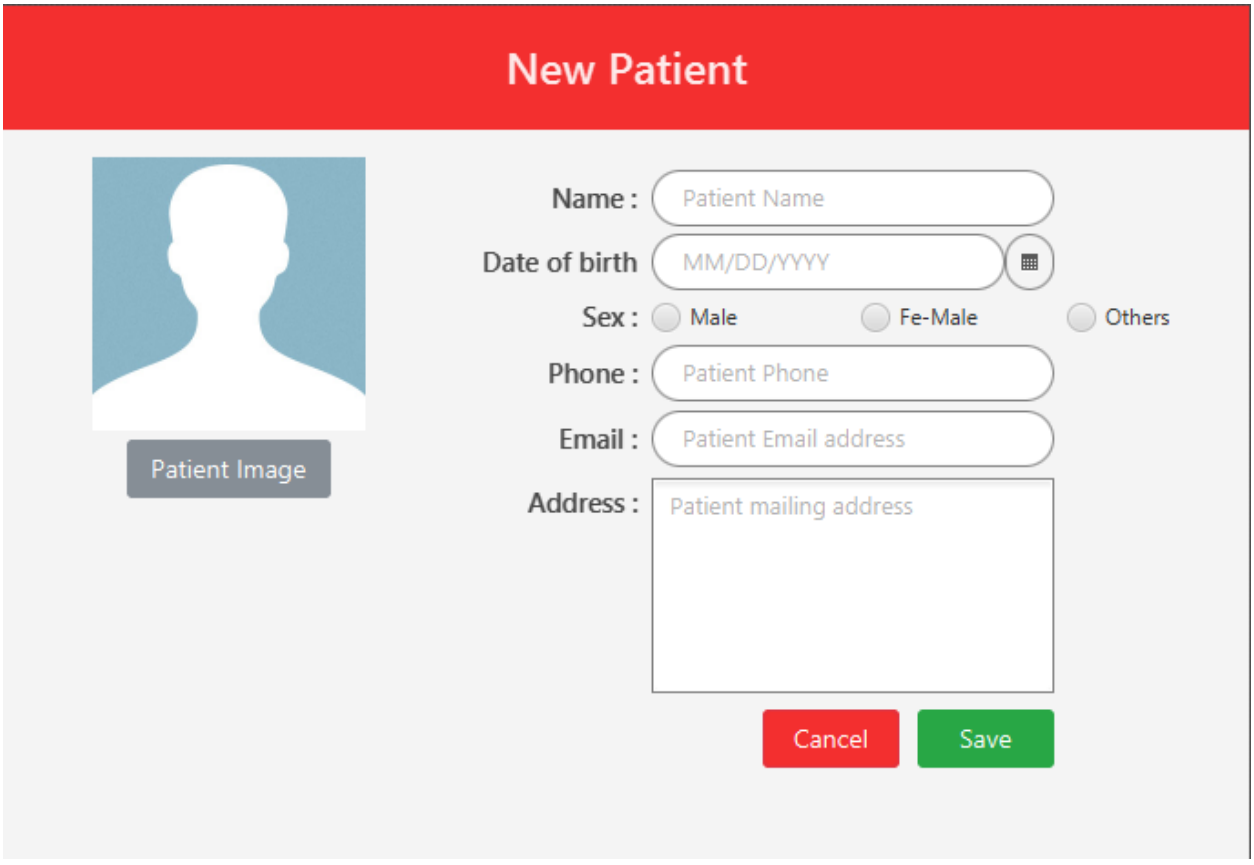
- The number of total patients in the system, and provide a add new patient button to add a new patient in the system.

- The number of total drugs in the system and provide the way of adding a new drug in the system by pressing an add new drug button.
- The number of total prescriptions in the system and provide the way of making new prescription by pressing the write new prescription button of the system.
- The number of available total prescription templates in the system and provide the way of creating the prescription template by pressing create new prescription template button.

When an add new patient button is clicked, then we see the new patient activity pop up:

Figure 15. Add new patient

Source: From Microsoft Paint

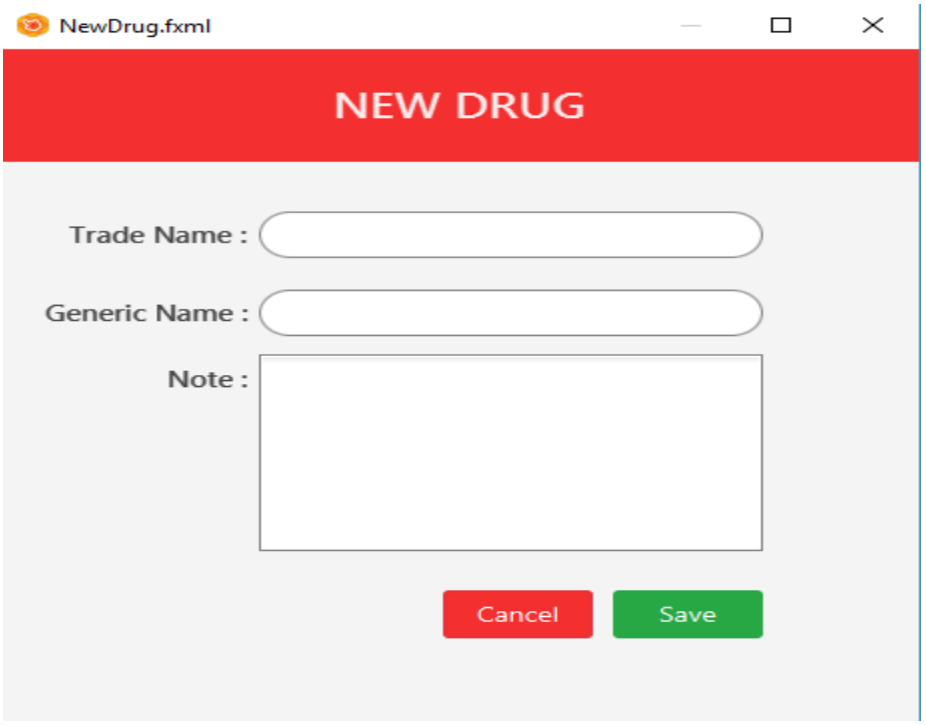


The interface new patient is used to add a new patient in the system with the information such as: his names when patient image button is pressed, date of birth, sex, phone, email address or location and the picture to be chosen from the computer. then we press **s**ave button for adding a patient.

When a new drug button is pressed then the new interface new drug is displayed

Figure 16. New drug interface

Source: From Microsoft Paint

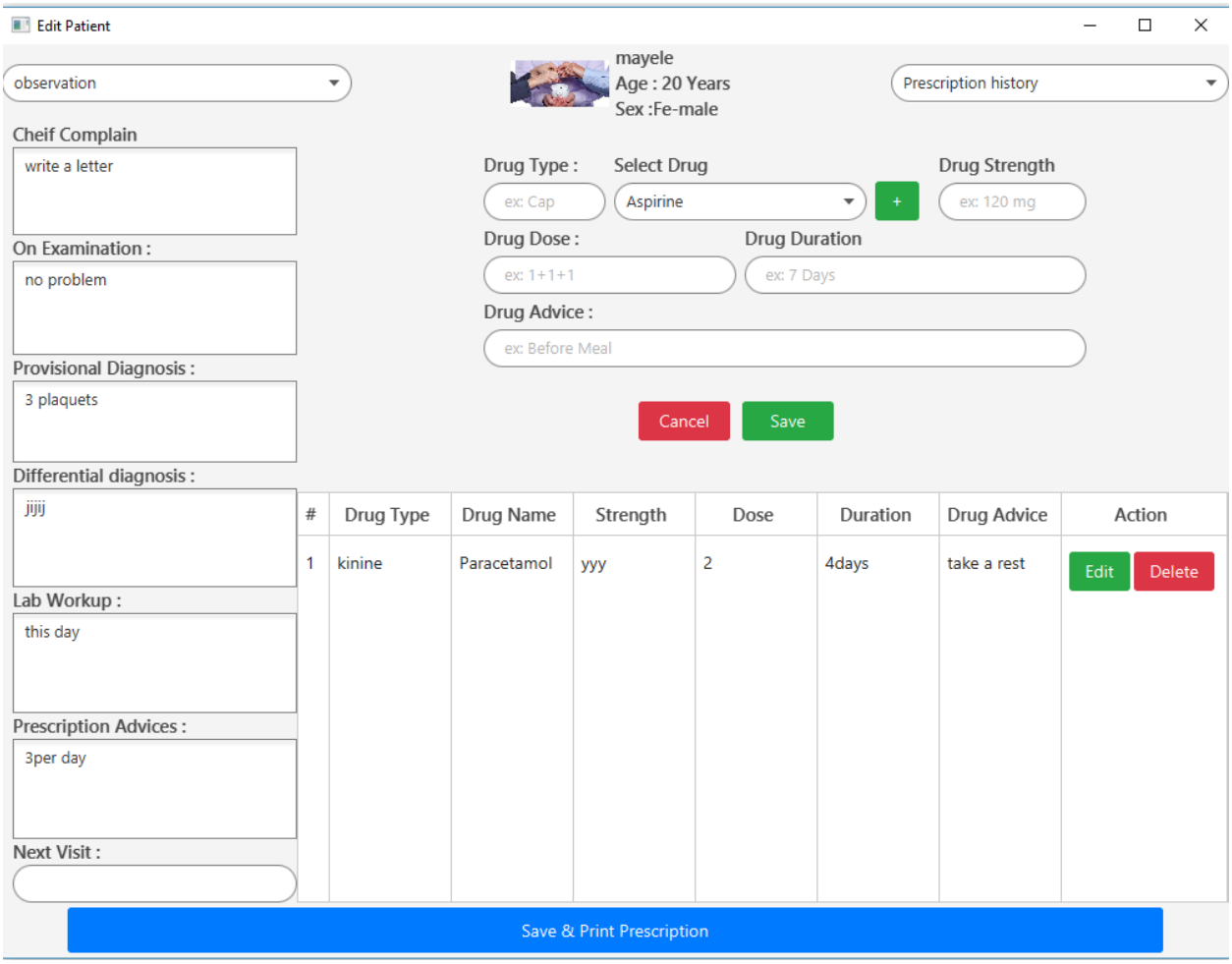


The add new drug interface is mainly used for inserting new drugs in the system using three fields and two buttons. The first field is trade name, the second is the generic name and lastly the third is note where a doctor can write some instruction related to the added drugs like, dose or duration.

When a button write new prescription is then the interface prescription appears.

Figure 17. Prescription interface

Source: From Microsoft Paint



This interface has all the information of the patient prescription, it has:

- A combo box from where we can select a template name for the prescription which help the user of the system to be fast with completion.
- Chief complain where the doctor can write some observation or main complain of the patient.
- On examination where the doctor can write the result of the examination of the patient in order to proceed with the patient diagnosis.

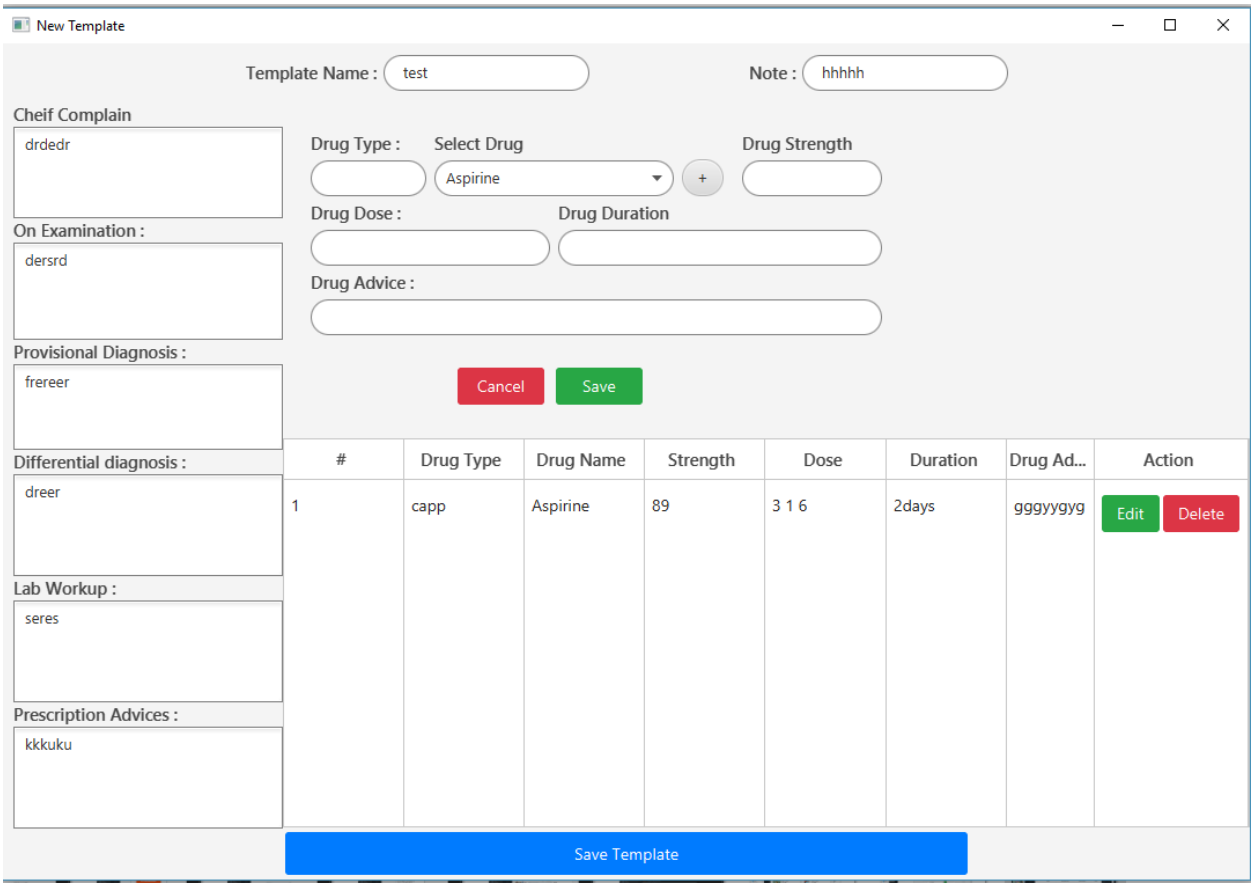
- Provisional diagnosis A provisional diagnosis is one to which the clinician is not yet committed. Specify a provisional diagnosis with the term (Provisional) Example: Axis I: 300.4, Dysthymic disorder (Provisional) You may choose to specify diagnoses that should be ruled out in order to commit to the provisional diagnosis.
- Differential diagnosis is the process of differentiating between two or more conditions which share similar signs or symptoms.
- Lab workup Laboratory test screening is helpful to identify markers that may suggest autoimmune inflammatory disease. Routine screening tests for undifferentiated connective-tissue disease (UCTD) should include the following: Complete blood count.
- Prescription advice is an order for the preparation and administration of a drug or device for a patient.
- Next visit here the doctor gives the next visit or appointment with him to the patient.
- Prescription history a combo box that contains different date in relation with the prescription saved in the system.
- Drug type there are essentially seven different drug types, each with its own set of characteristics, effects and dangers. Categories include stimulants, depressants, hallucinogens, dissociative, opioids, inhalants and cannabis.
- Combo box containing drugs name**,** in this combo box we need to choose a drug name depending on the need of doctor.
- A plus button for adding a new drug for the prescription.
- A drug strength indicates the amount of active ingredient in each dosage and is measured in unit of volume or concentration.
- Drug dose is the instruction given by the doctor based on how to take it and at which time after setting the drug.
- Drug duration is the length of time that particular drug is effective.
- Drug advice is the advice that a doctor provides to the patient during the period of taking drugs.

Table of prescription information is the table containing all the information about the prescription.

When a button saves and print prescription is pressed then the system directs you immediately to the printing interface.

Figure 18. Prescription template interface

Source: From Microsoft Paint

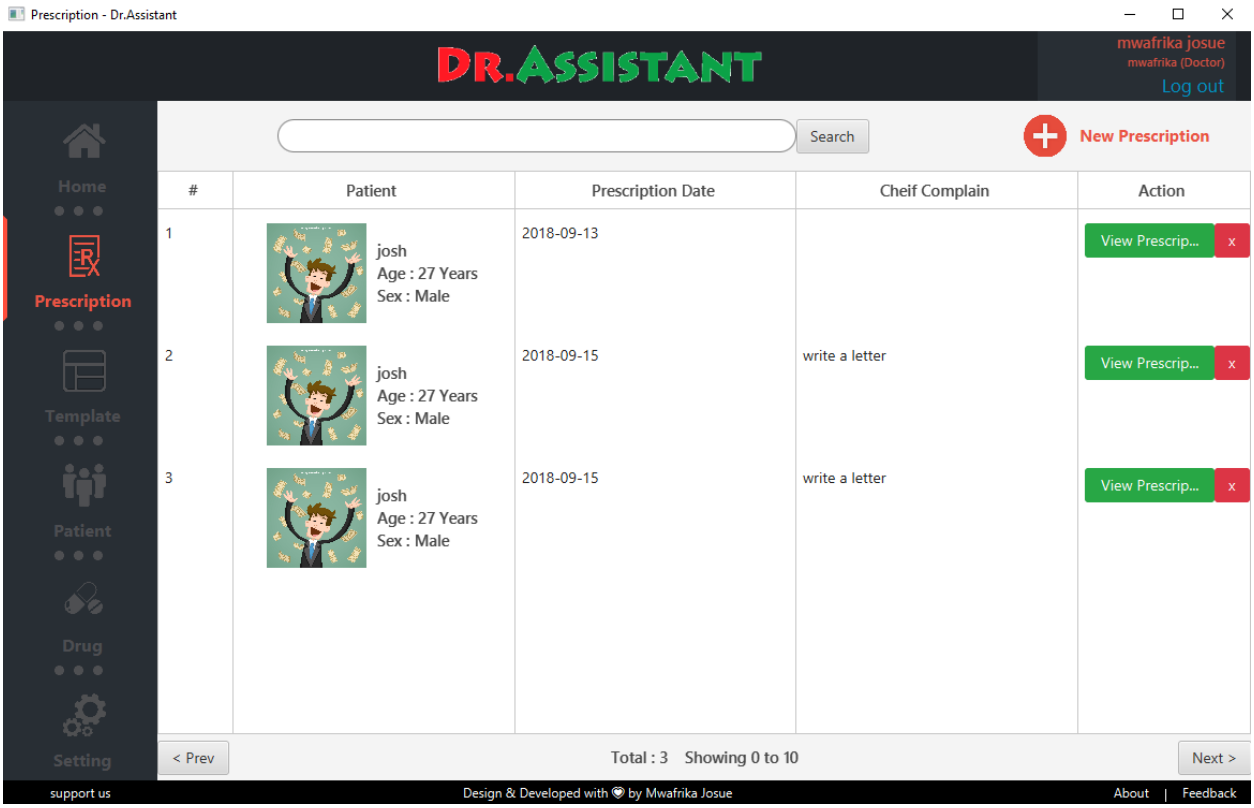


The user of the system can write many prescription templates in the system in order to be fast with the prescription when completing it.

It contains almost the same information as the prescription interface but in this we have the template name and the note for the patient.

Figure 19. Prescription list interface

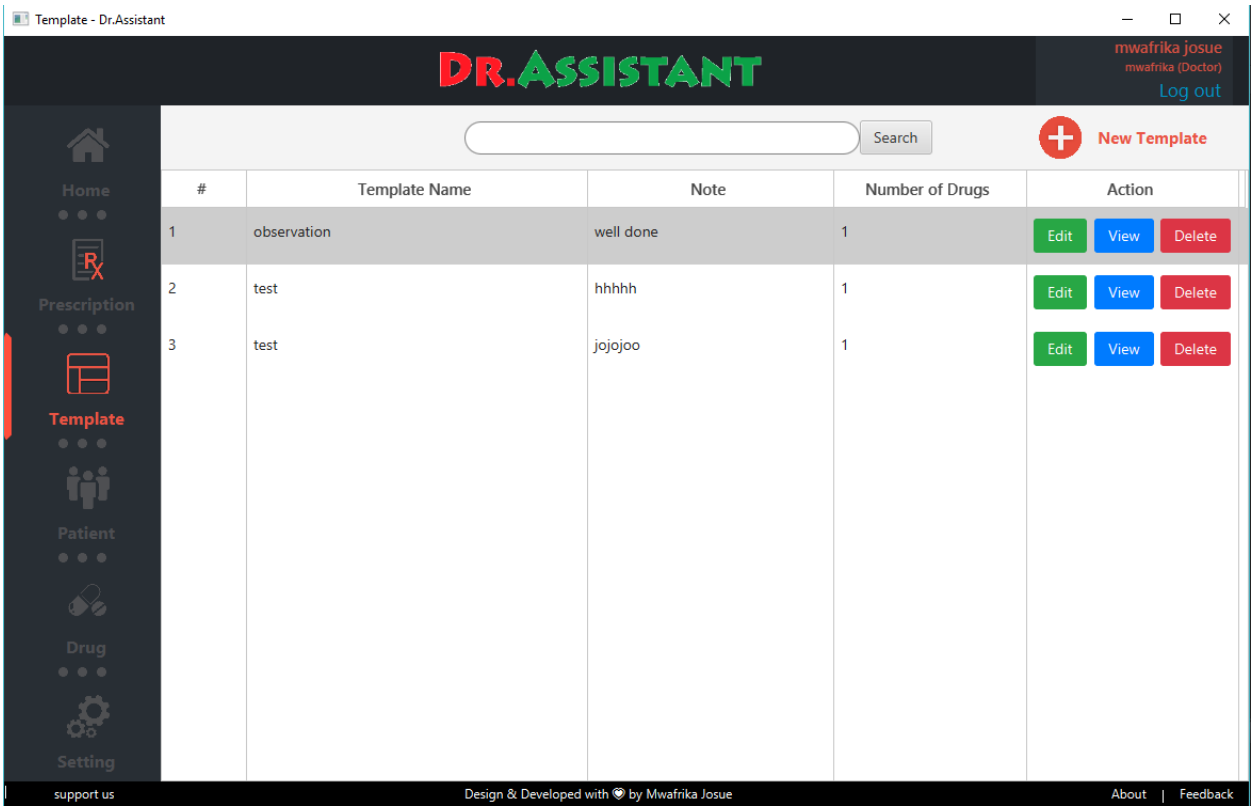
Source: From Microsoft Paint



In this interface we are able to see all the prescription list in the system, we have order number, patient description, prescription date, chief complain and action. When clicking the view prescription button, we can view the prescription details, the cross red button to delete the prescription and the new prescription button for adding

Figure 20. Template interface list

Source: From Microsoft Paint



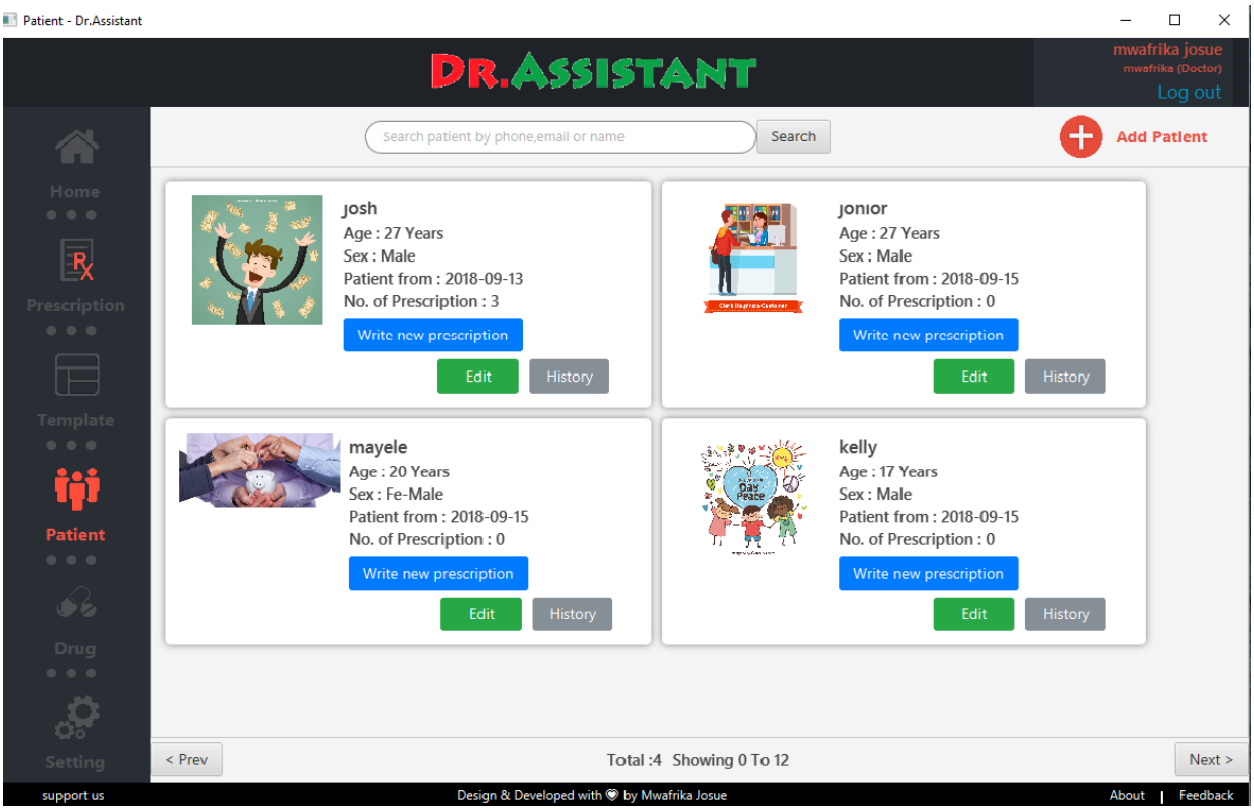
In this template interface we have the list of created templates, it contains the order number, template name, the note, the number of drugs and the action.

In action field we can be able to edit or update the template, we can be able to view the template or we can delete the template.

We can also add a new template when a plus button new template is clicked. If The number of templates is high, we can search through the search bar the name of the template.

Figure 21. Patients list interface

Source: From Microsoft Paint

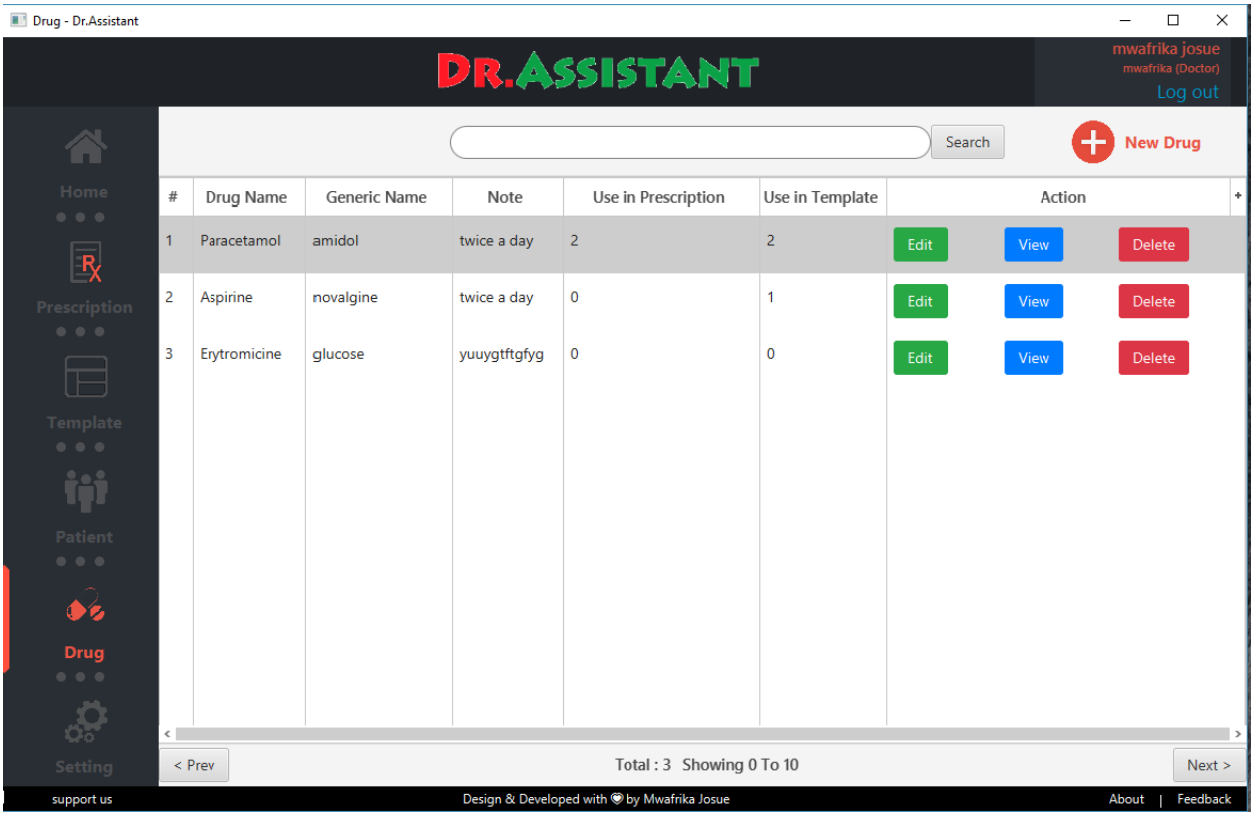


In this interface we have the list of patients registered in the system with their details such as name, age, sex, the date of the registration and the number of the prescription.

On each patient's details we have the write new prescription button to allow a doctor to add a new prescription for the patient. the doctor can view patient's history and he can edit patient's information.

Figure 22. Drug list interface

Source: From Microsoft Paint

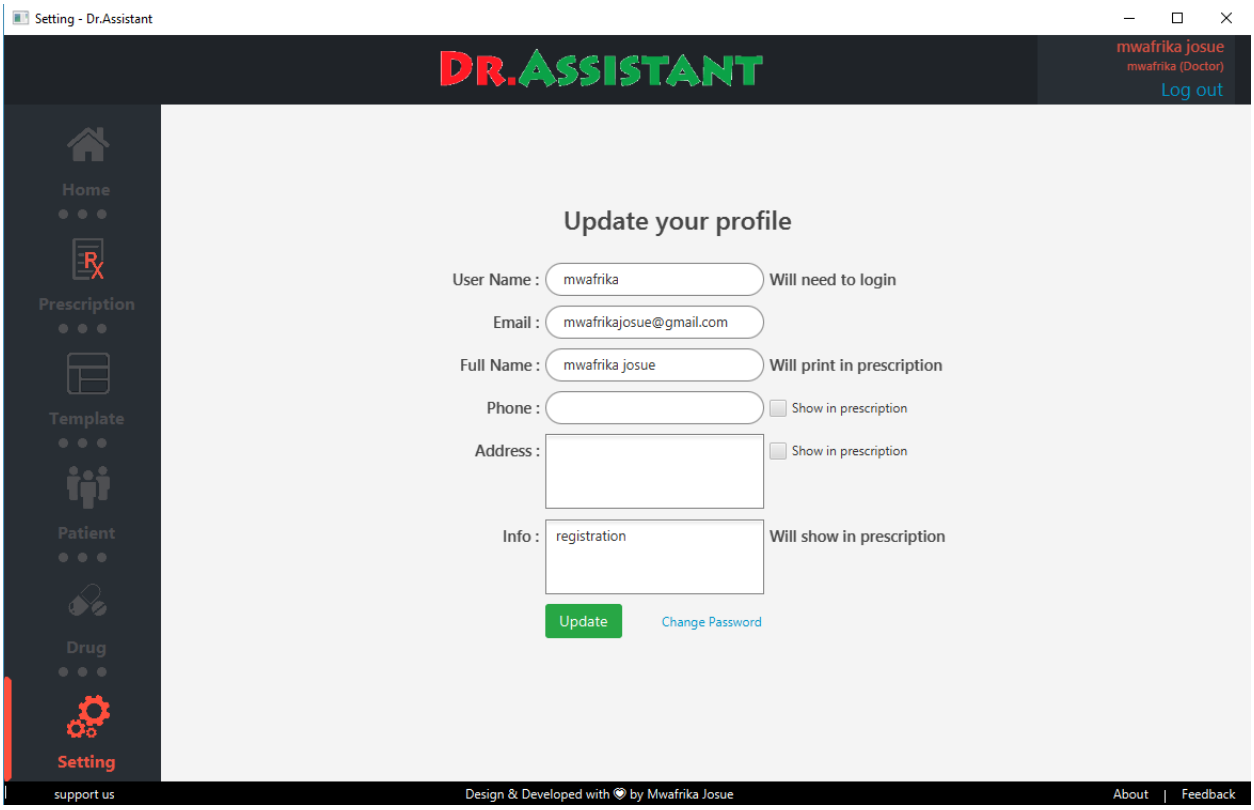


This interface contains all the information related to the drug such as the id of the drug, the drug name, the generic name, the note that contains some drug instruction, drug used in prescription, drug used in the template and the action field. In the action field we have three buttons; edit button for editing the drug information, view button for viewing the drug information and the delete button for deleting drug items.

We have the new drug button to add a new drug to the list of drugs and the search bar for searching the drug in the system by name or id drug.

Figure 23. The settings interface

Source: From Microsoft Paint

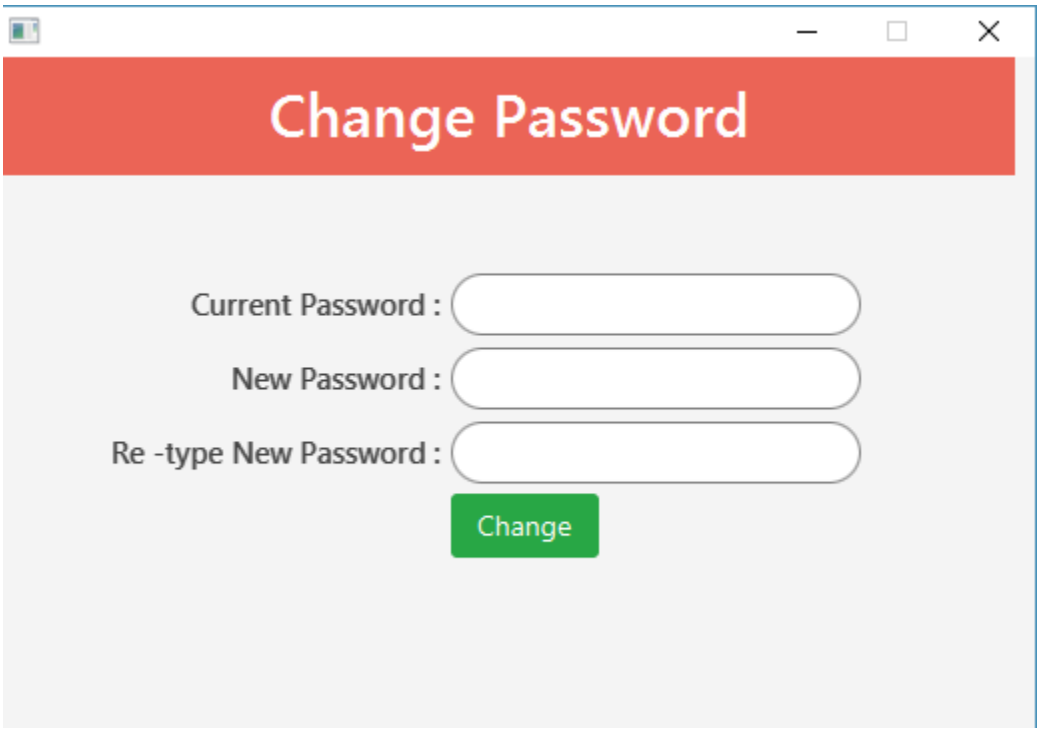


This interface is used to maintain the user profile of the system by updating the user information profile and contains some information such as user name, email, full name, phone address, info, show in prescription, the update button to update the user profile and change password.

When pressing the change password link, it brings the following interface:

Figure 24. Interface to change the password

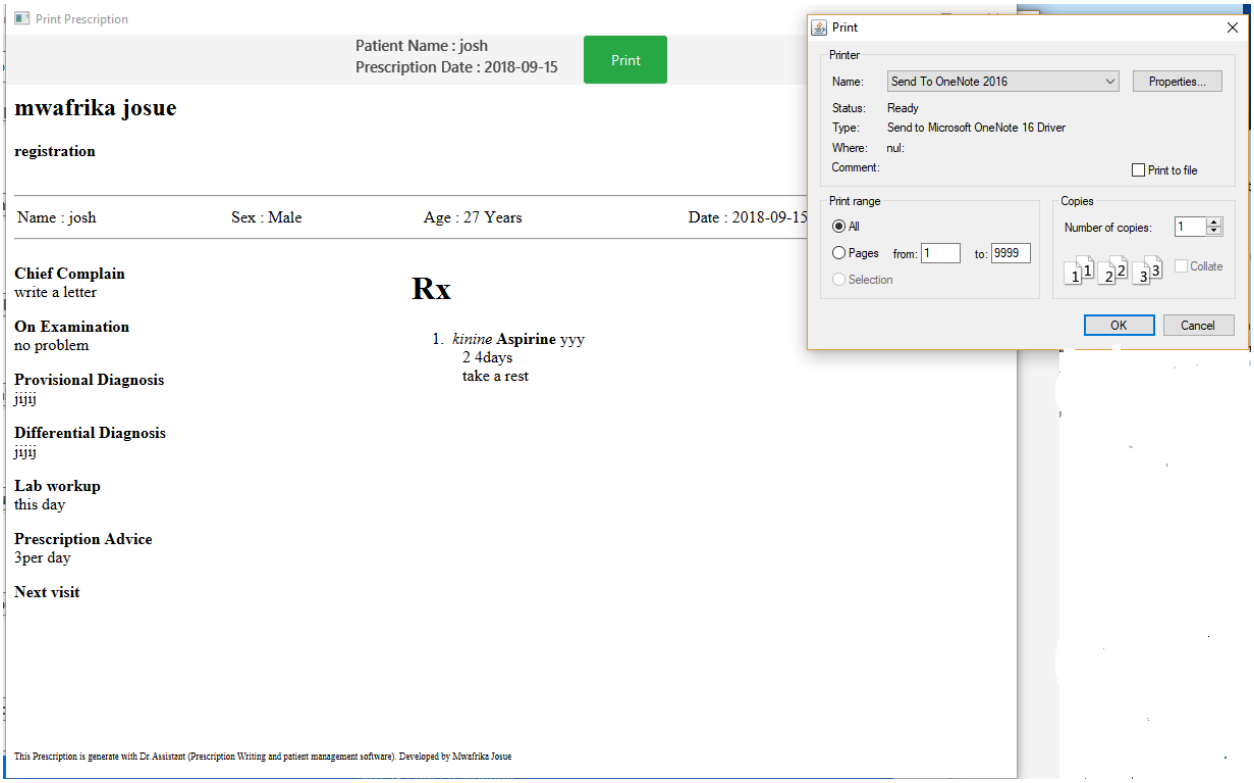
Source: From Microsoft Paint



On the change password interface, we have the current password field, the new password field and the Re-type new password for the confirmation of the password. This interface is used to help user or doctor to change the password when a given problem occurs or when we need to change it for a given purpose.

Figure 25. The printing interface

Source: From Microsoft Paint



the printing interface below is the interface that is used to print prescription report after that doctor of registered in the system has clicked on the save and print button which is in the prescription interface. When the button is clicked then the bellow interface appears with the list of prescription information concerning the patient. On this interface we have a green button on which we need to click so that we can print the document and we have also a small window that contains the printer information to be chosen before printing out the prescription.

CHAPTER V: CONCLUSION AND RECOMMENDATIONS

1.CONCLUSION

Through this system Doctor will be able to write patients prescription with a computerized system to improve the way of managing patient's prescription. all of the necessary information like medicines, tests, the future appointment with the doctor, different diagnosis, lab workup will be displayed on the screen after inserting all corresponding information of the patient.

Doctor just need to select the required patient containing all the necessary information about him such as test, medicine dose, and finally print the prescription.

The system monitors all the available patient's number, the available drugs number, available prescriptions number and available patients template number on the home interface. To allow the doctor or the user of the system to know the content number of the system without wasting time in checking in the database.

Patient with the id number or username can be track by doctor by searching from the database. doctor can add as many as prescription in the database, by using the prescription template the doctor manages very fast the patient's prescription. After the doctor has inserted patient information, the data will be saved in the history of the system so that the doctor can use the patient's history in the future by selecting the previous arrival date. The doctor can delete patient's information or the patient history if he does not need it anymore or can update information of the patient.

Finally, the doctor has the possibility of printing the prescription information of the patient that contains the next appointment with the doctor, drug dosage, and so many other information related to the patient.

2. RECOMMANDATIONS

In the future we recommend to other researchers interested in this project to implement another version of this software improve this project by adding other important features by:

- Adding an auto reminder for the patient appointment
- Designing a website for this project.
- To provide patient medical history
- To provide patient medical files
- Print prescription with fancy font
- Report: drug report, template report and schedule report.

We also recommend the General Hospital of North-kivu to use this system as it solves several previous problems of it during the execution of the tasks.

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